Exhibit 10

ICICLECREEK ENGINEERS

Revised Report
Geotechnical Engineering Services
Proposed 20-Lot Subdivision
King County Parcel Nos. 332406-9036
and 332406-9039
Issaquah, Washington

June 29, 2020
ICE File No. 1131-002

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Prepared For:
Boardwalk Real Estate LLC

Prepared By:
Icicle Creek Engineers, Inc.

June 29, 2020

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1.0 INTRODUCTION

This revised report presents the results of Icicle Creek Engineers' (ICE's) geotechnical engineering services for a proposed 20-lot subdivision within King County Parcel Nos. 332406-9036 and 332406-9039 (referred to collectively as the "Property") l in Issaquah, Washington. The Property, including nearby physical features, is shown on the Vicinity Map, Figure 1, and the Site Plan, Figure 2.

Our services were provided in general accordance with our Proposal dated April 10, 2020 and were authorized in writing by Kenneth W. Lyons of Boardwalk Real Estate LLC (Boardwalk), the property owner, on April 20, 2020.

2.0 BACKGROUND INFORMATION

ICE previously completed a preliminary coal mine hazard assessment of the Property and adjacent areas for Boardwalk; the results are presented in our report dated July 7, 2015. In addition, we completed a geotechnical consultation for a proposed 18-lot subdivision on the Property as summarized in our report dated June 18, 2016.

The development plans for the Property were revised after our 2016 report; the revised plans, prepared by D.R. Strong Consulting Engineers, dated August 30, 2018, included a proposed 20-lot subdivision with changes that required further geotechnical evaluation. We completed supplemental geotechnical services for this project in response to changes in the development plan and comments provided by the City of Issaquah (City) and the City's peer reviewers (Golder Associates and Wood) of ICE's 2015 and 2016 reports; the results are presented in our revised report, dated September 16, 2019 and our response to peer review comments dated October 2, 2019.

This revised report is intended to replace our report dated September 16, 2019.

Mr. Lyons provided ICE with a second round of City comments and peer reviewer comments related to our revised September 16, 2019 report. Mr. Lyons requested that ICE review and respond to the City's peer reviewer comments and provide an update to our 2019 report.

3.0 SCOPE OF SERVICES

The purpose of our services was to explore subsurface soil and groundwater conditions as a basis for developing geotechnical recommendations for development of the 20-lot subdivision project. Our specific scope of services included the following:

- Complete a detailed field reconnaissance to evaluate current surface conditions with emphasis in areas that contain Steep Slope or Landslide Hazard Areas.
- Explore subsurface soil and groundwater conditions by excavating 16 test pits using a track-mounted excavator subcontracted to ICE.
- Complete laboratory testing for moisture content and grain size distribution on soil samples obtained from the test pits.
- Provide a recommendation for exemption and/or a reduced buffer width from Steep Slope Hazard Areas, as appropriate.
- Provide recommendations for mitigation, including avoidance, related to Landslide Hazard Areas.
- Provide mitigation for residential development in Moderate Coal Mine Hazard Areas.
- Provide recommendations for site preparation and earthwork including stripping and excavation of unsuitable soils, fill compaction and subgrade preparation requirements, and suitability of on-site soils for use in structural fills. This included an evaluation of the effects of weather and/or construction equipment on the workability of site soils.
- Provide recommendations for foundation support for the proposed structures including allowable bearing pressures, settlement estimates and support of on-grade floor slabs and paved areas.
- Provide recommendations for underground utility installation including backfill materials, dewatering and shoring requirements, excavation and trench side slopes and placement and compaction of bedding and backfill materials.
- Provide preliminary recommendations for permanent open cut slopes and other slope support options including reinforced concrete walls, structural earth walls and gravity block walls.
- Complete slope stability analysis at critical sections where permanent open cut slopes and retaining walls are planned.
- Provide recommendations for stormwater vault site preparation, foundation support including allowable bearing pressures, settlement estimates and lateral pressures for subgrade walls.
- Provide recommendations for pavement subgrade preparation.
- Provide preliminary recommendations for surface and subsurface drainage systems as appropriate.
- Provide recommendations for temporary and permanent erosion control measures.

4.0 PROJECT DESCRIPTION

Our understanding of the project is based on discussions and email communications with Mr. Lyons and a meeting with the City and the project team on February 12, 2020. Mr. Lyons and Maher Joudi of D.R. Strong Consulting Engineers, the project civil engineer, provided ICE with the following set of updated plans (with City comments) and the most recent peer review comments for this project:

- D.R. Strong Consulting Engineers, August 30, 2018, revised June 29, 2020 (City Comments, 2nd Round), *Mine Hill Road, 345 & 375 Mine Hill Road SW, Issaquah, Washington*, sheets C1 through C10.
- City of Issaquah Development Services Department, December 24, 2019 (2nd Comments), *Permit No. PP18-00003, Peer Review Comments by Wood*, 7 pages.
- City of Issaquah Development Services Department, January 20, 2020, *Permit No. TBD, Peer Review Comments by Golder Associates,* 4 pages.

Based on our review of the plans (D.R. Strong Consulting Engineers, revised June 29, 2020), the project includes the development of 20 residential lots with paved access. The Property is located within a gently to moderately sloping area in the lower hillside area of Squak Mountain. Mine Hill Creek crosses the east part of the Property within a well-defined, steep-sided ravine. Lot 3 and a portion of Lot 2 in the southeast part of the Property are located within a Moderate Coal Mine Hazard Area as described in ICE's July 7, 2015 report. The remainder of the lots are within a Declassified Coal Mine Area. The Coal Mine Hazard Areas as described in detail in ICE's July 7, 2015 report are shown on Figure 2.

Existing Structures – Three houses exist on the Property within or adjacent to Lots 1, 3 and 6. The house adjacent to Lot 6 will be demolished and removed from the Property. The houses on Lots 1 and 3 will remain.

Access (Lots 1, 2 and 3) – Lots 1, 2 and 3 will be accessed directly off of Mine Hill Road SW as shown on Figure 2.

Access (Lots 4 thru 20) – A new access road will be constructed extending north-south along the west side of the existing Mine Hill Apartments site (north of the Property) connecting to the west end of Clark Street NW (shown as the New Access Road on Figure 2). The New Access Road will connect to Road A in the northwest corner of the Property; Road B intersects with Road A as shown on Figure 2.

The east side of the New Access Road will be constructed/widened with fill to create a sidewalk area and will be supported by a retaining wall up to about 3-feet high. The south end of the new access road where it turns east to Road A will require a cut up to about 12-feet high. The cut will be supported by a retaining wall up to about 8-feet high with a 2H:1V (horizontal to vertical) cut slope above.

Lots 1, 2 and 3 – At this time, no grading or new structures are currently planned within Lots 1, 2 and 3.

Lot 4 –This lot will be graded by placing up about 6 feet of fill along the east and north side of the lot to form an open 2H:1V fill slope.

Lot 5 – Minor grading is planned for this lot with a cut (west part of lot) and fill (north part of lot) up to 2-feet thick.

Lots 6 through 14 –The lots will be graded by placing fill at the north end of the lot to create a 2H:1V slope up to about 6-feet high, supported by a 3- to 6-foot-high retaining wall; up to about 10 feet of fill will be placed to grade this area.

Lots 15 through 20 –The lots will be graded by cutting the hillside along the west property line at 3H:1V for an overall slope height of about 16 feet, then cutting a bench to the east that is bordered by an approximate 8- to 10-foot-high cut slope inclined at 2H:1V. The cut along the south end of Lot 20 (south end of project area) will be supported by a retaining wall up to about 6-feet high.

Tract A – Tract A contains the Mine Hill Creek Ravine and will remain undeveloped with the exception of two 15- to 20-foot wide utility easements within the north part of the tract as shown on Figure 2. The easements include a proposed sanitary sewer and water easement extending generally west from Mine

Hill Road SW to the east end of Road A and a proposed stormwater drainage easement extending from the proposed stormwater detention vault in Tract B (described below) through Tract A down to the base of the Mine Hill Creek Ravine. A pedestrian trail easement is located along the same alignment as the sanitary sewer and water easement. This majority of the alignment has been previously graded as it follows an existing driveway.

Tract B (Stormwater Drainage and Open Space) – Tract B primary use will be for stormwater detention and disposal. Stormwater runoff (primarily from roof areas and roads) will be routed to an underground stormwater detention vault; specific details of the stormwater vault are not known as this time. Stormwater overflow from this vault will be conveyed downslope (to the southeast) by a buried outlet pipe and discharged at the base of the slope adjacent to Mine Hill Creek.

Tract C (Class 4 Stream) – Tract C is the location of a Class 4 stream and will remain undeveloped. We understand that the stream is defined by a zone of intermittent (seasonal) surface water that was observed between Lots 4 and 5. The proposed plan includes installation of a dispersion trench at the north end of Lot 4 and an interceptor trench at the south end of Lot 5 to manage shallow groundwater associated with the stream along the edge of the tract.

Underground Utilities – Water and sanitary sewer mains will be installed within the proposed underground utility easement in the north part of Tract A as shown on Figure 2. We expect that Road A and Road B will include underground utilities (water, sewer, power and cable) with a burial depth of less than 6 feet. Based on information provided by Mr. Joudi, we understand that water and sanitary sewer mains will be installed within the utility easement in Tract A at depths up to about 5 feet (water) and 19 feet (sanitary sewer). A stormwater vault outlet pipe is planned at a depth up to about 14 feet within the stormwater drainage easement.

5.0 REGULATORY CONSIDERATIONS FOR CRITICAL AREAS

5.1 COAL MINE HAZARD AREAS

As previously described, ICE completed a preliminary coal mine hazard assessment report dated July 7, 2015 (Critical Areas Report). The majority of the Property is within a *Declassified Coal Mine Area* and can be developed without restriction associated with coal mine hazards, except for Lots 2 and 3 which are within (Lot 3) or partly within (Lot 2) a Moderate Coal Mine Hazard Area.

5.2 STEEP SLOPE HAZARD AREAS

The City of Issaquah Municipal Code (IMC) Chapter 18.10.390 defines a *Steep Slope Hazard Area* as *any ground that rises at an inclination of forty (40) percent or more within a vertical elevation change of at least ten (10) feet (a vertical rise of ten (10) feet or more for every twenty-five (25) feet of horizontal distance).* For the purpose of this definition, *a slope is delineated by establishing its toe and top and [is] measured by averaging the inclination over at least ten (10) feet of vertical relief.*

IMC Chapter 18.10.580.E.1 allows for alterations of slopes which are *(40) percent and steeper with a vertical elevation change of up to twenty (20) feet may be exempted from the provisions of this section (through Level 1 Review or through the appropriate land use permitting process), based on the City review and acceptance of a soils report prepared by a geologist or licensed geotechnical engineer when no adverse impact will result from the exemption*.

IMC Chapter 18.10.580.E.2 indicates that *any slope which has been created through previous, legal grading activities may be regarded as part of an approved development proposal. Any slope which remains equal to or in excess of forty (40) percent following site development shall be subject to the protection mechanisms for steep slopes.*

IMC Chapter 18.10.580.A.1 requires that *a minimum buffer shall be established at a horizontal distance of fifty (50) feet from the top or toe and along all sides of slopes forty (40) percent or steeper. Existing native vegetation within the buffer area shall be maintained and the buffer shall be extended beyond these limits as required to mitigate landslide and erosion hazards, or as otherwise necessary to protect the public health, safety and welfare.*

IMC Chapter 18.10.580.A.2 allows that the *buffer may be reduced to a minimum of ten (10) feet when an applicant demonstrates to the Director, pursuant to a critical areas study, that the reduction will not reduce the level of protection to the proposed development and the critical area as provided by the fifty (50) foot buffer. An occupied building shall not be closer than twenty-five (25) feet (including buffer) to the toe of a steep slope (or altered steep slope).*

5.3 LANDSLIDE HAZARD AREAS

IMC Chapter 18.10.390 defines *Landslide Hazard Areas* as *those areas of the City subject to a severe risk of landslide. A geotechnical report is required for all relevant projects to determine steepness of slope, permeability of soils, occurrence of springs, and groundwater level. The study shall be performed by a licensed geotechnical engineer. Landslide hazard areas include the following areas:*

- *A. Slopes greater than forty (40) percent.*
- *B. Any area with a combination of:*
  - *1. Slopes of greater than fifteen (15) percent;*
  - *2. Impermeable soils (typically silt and clay) frequently interbedded with granular soils (predominantly sand and gravel); and*
  - *3. Springs or groundwater seepage.*
- *C. Any area which has shown movement during the Holocene epoch (from ten thousand (10,000) years ago to present) or which is underlain by mass wastage debris of that epoch.*
- *D. Any area potentially unstable as a result of rapid stream incision, stream bank erosion, or undercutting by wave action.*
- *E. Any area which shows evidence of, or is at risk from, snow avalanches.*
- *F. Any area located on an alluvial fan, presently subject to or potentially subject to, inundation by debris flows or deposition of stream-transported sediments.*

IMC Chapter 18.10.560.C.1 indicates a *Landslide Hazard Area located on a slope forty (40) percent or steeper shall be altered only as allowed under standards for steep slope hazard areas. A landslide hazard area, located on a slope less than forty (40) percent, may only be altered under the following circumstances:*

- *a. The development proposal will not decrease slope stability on adjacent properties; and*
- *b. The landslide hazard area can be modified or the development proposal can be designed so that the landslide hazard to the project and adjacent property is eliminated or mitigated, based on criteria including altering of drainage patterns and subsurface flow, and the development proposal on that site is certified as safe by a licensed geotechnical engineer.*

5.4 EROSION HAZARD AREAS

IMC Chapter 18.10.390 defines *Erosion Hazard Areas* as *those areas of King County and the City containing soils which, according to the USDA Soil Conservation Service, the 1973 King County Soils Survey and any subsequent revisions or additions thereto, may experience severe to very severe erosion hazard. This group of soils includes, but is not limited to, the following when they occur on slopes of fifteen (15) percent or greater: Alderwood gravelly sandy loam (AgD), Alderwood-Kitsap (Akf), Beausite gravelly sandy loam (BeD and BeF), Kitsap silt loam (Kpd), Oval gravelly sand loam (OvD and OvF), Ragnar fine sandy loam (RaD), Ragnar-Indianola Association (RdE), and any occurrence of River Wash (Rh).*

The US Department of Agriculture Natural Resource Conservation Service (NRCS) Web Soil Survey was reviewed to further delineate Erosion Hazard Areas. The NRCS has mapped the soils underlying the Property as Kitsap silt loam (KpC - 8 to 15 percent slopes and KpD - 15 to 30 percent slopes) which are characterized as having a severe erosion hazard.

5.5 SEISMIC HAZARD AREAS

IMC Chapter 18.10.390 defines *Seismic Hazard Areas* as *those areas of the City subject to severe risk of earthquake damage as a result of seismically induced settlement or soil liquefaction. These conditions may occur in areas underlain by cohesionless soils of low density usually in association with a shallow groundwater table.*

6.0 SITE CONDITIONS

6.1 GENERAL

Jeff Schwartz, a licensed engineering geologist with ICE, visited the Property on June 18, 2015 (related to ICE's July 2015 report), on March 24 and 29, and April 1, 2016 (related to ICE's June 2016 report) and more recently on June 28 and July 2, 2019 to observe and evaluate site conditions.

Our understanding of the Property area is based on our review of in-house geological and geomorphic information, historical aerial photograph review (Google Earth and USGS), detailed surface reconnaissance in accessible areas and observations of subsurface conditions in the test pit explorations.

As part of our field and office evaluation, ICE obtained LiDAR Digital Terrain Model (DTM) data (King County 2016) from the Washington State Department of Natural Resources (DNR) Washington LiDAR Portal (http://lidarportal.dnr.wa.gov/). The LiDAR raw data was processed by ICE using the Environmental Systems Research Institute (Esri) ArcGIS 10.6 for 2-foot contour intervals and slopes 40 percent and greater to aid in our geotechnical evaluation.

6.2 SURFACE CONDITIONS

General – The Property is located on an overall northeast-to east-facing hillside near the base of Squak Mountain overlooking the City of Issaquah and the Issaquah Creek valley. The Property is bordered by Mine Hill Road SW to the east, and more densely developed residential properties to the north, west and south.

The Property is crossed diagonally from the southwest to the northeast by Mine Hill Creek which occupies a well-defined ravine. Local areas of the ravine sideslopes are inclined at more than 40 percent grade and are between about 10 and 20 feet in height; these are shown as Steep Slope Hazard Areas on Figure 2.

Based on our site observations, it appears that fill is present along the west property line that was apparently placed to create yard areas for the bordering existing residential properties.

Lots 1, 2 and 3 – Lots 1, 2 and 3 are located in the east part of the Property and are bordered by Mine Hill Road SW to the east, rural residential property to the south and a ravine that contains Mine Hill Creek to the north and west. The ground surface slopes gently to the north-northeast at about a 10 percent grade. Two houses that were constructed in the early 1900s (King County iMap, https://gismaps.kingcounty.gov/iMap/Tax Assessor information) currently exist in the east part of this area, bordering Mine Hill Road SW. The house sites are bordered by lawn/landscaped areas along with scattered deciduous trees and dense brush, especially in the Lot 1 area.

A Moderate Coal Mine Hazard Area crosses the southeast part of Lot 2 and all of Lot 3 as shown on the Critical Areas Map, Figure 3. Details of the Preliminary Coal Mine Hazard Assessment are included in ICE's report dated July 7, 2015.

Lots 4 and 5 and Tract C (Class 4 Stream) – Lots 4 and 5 and Tract C are located in the south-central part of the Property and are bordered to the west by Road B, to the north by Road A, to the south by rural residential property and to the east by Tract A and the Mine Hill Creek Ravine. The ground surface slopes gently down to the northeast at about a 10 to 15 percent grade.

Lots 6 through 14 – Lots 6 through 14 are located along the north property line and are bordered to the north by the Mine Hill Apartments, to the west by the new access road off Clark Street SW, Road A to the south and Tract B (the stormwater area) to the east. The ground surface slopes gently down to the northeast at about a 12 to 16 percent grade.

Lots 15 through 20 – Lots 15 through 20 are located in the southwest part of the Property and are bordered by Road A to the north, an older residential subdivision to the west, Road B to the east and rural residential property to the south. The ground surface slopes moderately down to the northeast at about a 7 to 25 percent grade, steepening to the west. Based on our site observations, it appears that fill is present along the west property line that was apparently placed to create a yard area for the bordering existing residential properties.

We observed an isolated sloping area west of Lots 16 and 17 that is inclined at more than 40 percent grade and is up to about 12-feet high; this area is shown as a Steep Slope Hazard Area on Figure 3 (Slope 1). This area appears to be associated with fill that was placed during development of the adjacent properties. This area appeared densely vegetated and stable. We completed a global stability analysis through this slope as described in section **7.0** of this report.

Tract A (Mine Hill Creek Ravine; includes the underground utility easements) – Tract A contains the Mine Hill Creek ravine crosses the Property from the southwest to the northeast and is bordered on the east by Lots 1, 2 and 3 and to the west by Lots 4, 5 and 6. The underground utility easement for water and sewer is located in the north part of this ravine as shown on Figure 2. Currently this area is undeveloped and forested. An existing house is located partially within Tract A near the east end of Road A.

We completed a detailed field reconnaissance of the ravine slopes as part of the Critical Areas evaluation for this project. The ravine slopes were observed to be generally dry and planar surfaced. Steep Slope Hazard Areas (slopes greater than 40 percent grade and greater than 10-feet high) that we recommend be exempt from Steep Slope Hazard regulation (as described in section **8.2.2** of this report) were identified along the ravine slopes as shown on Figure 3. Details of site observations along these slopes are presented below:

Slope Number[1] (Location)	Slope Height and Inclination[2]	Vegetation Type	Other Observations
Slope 2 (east side of ravine)	Between 12- and 19-feet high with an average slope between about a 60 and 80 percent grade	Mature deciduous trees (mostly multiple trunk broadleaf maple and alder) with occasional cedar trees, dense understory of ivy, other brush and knotweed closer to the base of the ravine	Dry, planar slopes, no bare soil or erosion observed
Slope 3 (west side of ravine, south of utility easement)	Up to 16-feet high with an average slope between about 40 and 75 percent grade	Mature deciduous trees (predominately broadleaf maple and alder), moderately dense to dense understory of ivy and other brush	Dry, mostly planar slopes. Bedrock exposures along the ravine slopes. No base soil or erosion observed
Slope 4 (west side of ravine, north of utility easement)	Up to 12-feet high with an average slope between about 40 and 70 percent grade	Predominately mature vertical conifers	Dry, planar slopes, oversteepened adjacent to the existing driveway. No bare soil or erosion observed

(1) Steep Slope Hazard Areas are shown on Figure 3 with the slope number referenced

(2) Slope height and inclination are based on the topographic survey by others and our field review

We observed a concave-shaped slope (about 75-feet long) along the west side of the ravine centrally within the Property. The steepest portion of this slope is located at the bottom of the feature where the slope is inclined at an average 70 percent grade (steepening along the stream bank) and is about 16-feet high; this slope is shown as a regulated Steep Slope Hazard Area (Slope 5) on Figure 3. At the top of this feature, we observed a zone of groundwater seepage with skunk cabbage and horsetail and dense brush along a slope between about 15 and 40 percent grade and a distinct incised channel (with very low volume flow). Based on our observations and IMC Chapter 18.10.390 definitions, this described feature is a Landslide Hazard Area, as shown on Figure 3.

We observed the bankfull width of the stream channel in the ravine to be about 10-feet wide on average. The stream channel was observed to be well-armored with gravel and cobbles and normal streambanks with minimal undercutting (erosion). We observed areas where competent bedrock was exposed along the streambanks.

Except for Mine Hill Creek and the seepage area described above, no surface water was observed on the Property at the time of our reconnaissance. We did not observe surface evidence of slope instability, such as bare soil scarps, groups of leaning or toppled trees, or benched or hummocky topography within or adjacent to the Property.

Tract B (Stormwater Drainage/Open Space) – Tract B is located in the north central part of the Property and is bordered to the north by the Mine Hill Apartments, to the west by Lot 6 and to the south and east by the Mine Hill Creek ravine. The ground surface within Tract B slopes gently down to the southeast at less than 10 percent grade. The planned stormwater vault outlet pipe extends southeast and descends the Mine Hill Creek hillside (in the area of Slope 3). Currently this area, including the outlet pipe alignment that descends the Mine Hill Creek hillside, is undeveloped and forested.

6.3 GEOLOGIC AND GEOMORPHIC SETTING

The surficial geology in the Property area has been mapped by the US Geological Survey (USGS, 2006, *Geologic Map of the Issaquah 7.5' Quadrangle, King County, Washington*, in review, Miscellaneous Field Studies, scale 1:24,000) as Renton Formation bedrock. Renton Formation bedrock consists of non-marine sandstone and shale with coal seams. The Renton Formation bedding dips at roughly 35 to 40 degrees downward to the north beneath the Property. We observed exposures of Renton Formation bedrock along the base of the slopes within the ravine (along its west side). Though not regionally mapped by the USGS, the Renton Formation bedrock is typically overlain by Glacial Drift consisting of silt, sand and gravel with occasional cobbles and boulders.

We reviewed regional geologic mapping by the US Geological Survey (USGS, Booth, D.B, et al, 2006, *Geologic Map of the Issaquah 7.5' Quadrangle, King County, Washington*, Scientific Investigations Map) and the DNR (Sarikhan, Isabelle and Walsh, T.J., October 2007, *LHZ – Final A-1 Map, Tiger Watershed*, scale 1:12,000). The DNR (October 2007) shows a landslide area north of the Property (DNR Landslide ID No. 42077(2383). More recent (2016) detailed landslide mapping by King County (https://gismaps.kingcounty.gov/iMap/ - Landslide layer) clearly shows an area that "*contains all features of a deep-seated landslide*" within the location mapped by the DNR (October 2007) which is north of the Property. King County describes this landslide area as "*pre-historic.*" Based on our review of the Lidar hillshade image (https://gismaps.kingcounty.gov/iMap/ - Basemap Gallery, Hillshade), we concur with the regional geologic mapping by DNR (2007) and King County (2016) that no landslide occurs within the Property.

6.4 SUBSURFACE CONDITIONS

6.4.1 General

Subsurface conditions at the site were explored by excavating ten test pits (Test Pits TP-2 though TP-11) to depths ranging from about 8 to 14 feet on April 1, 2016 using a Bobcat E45 trackhoe owned and operated by Calvin Beedle Excavating LLC of Cle Elum, Washington. Six additional test pits (Test Pits TP-12 through TP-17) were completed to depths ranging from about 8 to 10 feet on July 2, 2019 using a Bobcat 435 mini-trackhoe owned and operated by Kelly's Excavating Inc. of Pacific, Washington.

Test Pit TP-1 was excavated on an adjacent property for the purpose of a separate geotechnical evaluation and is not included in this report.

Locations of the test pits were obtained in the field by measuring distances from existing site features and using a hand-held GPS (Garmin 62st) and using a georeferenced digital site map. The approximate locations of the test pits are shown on Figure 2.

The test pit excavations were observed by Mr. Schwartz who examined and classified the soils encountered, observed groundwater conditions and prepared a detailed log of each test pit. Soils were classified in general accordance with the classification system described in Figure 4. The logs of the test pits are presented in Figures 5 through 9. These logs are based on our interpretation of the field data and indicate the various types of soils encountered. They also indicate the depths at which the soils or their characteristics change. The densities noted on the test pit logs are based on the difficulty of digging, probing with a ½-inch-diameter steel rod, and our experience and judgment.

The soil samples obtained from the test pits were returned to ICE's laboratory for further visual examination and laboratory testing. Soil samples obtained from the test pits were tested to evaluate moisture content in general accordance with ASTM Test Method D 2116. The results of the moisture content tests are presented in Figure 10. A soil sample was also tested to evaluate particle size distribution (grain size analysis) by ASTM Test Methods C117 (modified) and C 136; the particle size distribution report is presented in Figure 11.

6.4.2 Soil and Bedrock Conditions

The following is a description of the soil types and bedrock encountered in the test pit explorations.

Fill (Test Pits TP-14, TP-16 and TP-17) – Up to 3 feet of Fill was observed in Test Pits TP-14, TP-16 and TP-17. The Fill typically consisted of medium dense silty sand with variable amounts of gravel and roots or medium dense gravel with variable amounts of silt, sand, cobbles and roots. A 1-foot-thick surface layer of quarry spalls (broken rock) was encountered in Test Pit TP-16.

Alluvium (Test Pit TP-16) – Soft organic sandy silt and gravel with clay, silt, sand and occasional cobbles was encountered in Test Pit TP-16. Alluvium is a recent soil deposited (sedimentation) by Mine Hill Creek.

Topsoil and/or Weathered Soil – Up to about 4 feet (average thickness of about 2.5 feet) of Topsoil and/or Weathered Soil was encountered in the explorations, with the exception of Test Pit TP-16. The Topsoil and/or Weathered Soil typically consisted of soft to medium stiff silt and sandy silt with variable amounts of gravel and roots, or loose sand and gravel with variable amounts of silt, cobbles and roots.

Glacial Drift – Up to about 11.5 feet (average thickness of about 4 feet) of Glacial Drift as encountered in the explorations, with the exception of Test Pits TP-5, TP-9 and TP-16. The Glacial Drift typically consisted of medium dense to dense sand and gravel with variable amounts of silt, cobbles and bedrock fragments, or stiff to hard silt with variable amounts of sand. The soil types were often stratified (horizontally-layered) and appear to have been overridden by glacial ice as evidenced by the typically dense condition.

Highly Weathered Bedrock – Highly Weathered Bedrock was encountered in the explorations, with the exception of Test Pits TP-4, TP-7, TP-8, TP-14 and TP-15. The Highly Weathered Bedrock typically consisted of medium dense to dense sand/silty sand or medium stiff to hard sandy silt/silt.

Moderately Weathered Bedrock – Moderately Weathered Bedrock was encountered in Test Pits TP-2, TP-5, TP-6, TP-9, TP-10 and TP-11. The Moderately Weathered Bedrock typically consisted of dense fine-grained sandstone or hard siltstone.

6.4.3 Groundwater Conditions

Groundwater was encountered in all of the explorations except for Test Pits TP-12, TP-13, TP-15 and TP-17. The groundwater was typically observed to be emanating from thin layers in the walls of the test pits. We expect this groundwater is perched or contained within the more permeable layers and may dry out by late summer. However, groundwater is likely perennial in the floor of the Mine Hill Creek ravine.

6.4.4 Other Observations

Excavatability of the site soils and bedrock using a Bobcat E45 trackhoe and 435 mini-trackhoe was typically easy (Topsoil/Weathered Soil) to moderately difficult (Glacial Drift and Highly/Moderately Weathered Bedrock). Based on our experience, the bedrock can be excavated easily to a depth of about 5 feet using conventional heavy equipment, becoming increasingly difficult with depth.

Slight to moderate caving of the test pit sidewalls occurred during excavation of Test Pits TP-3, TP-4, TP-8 and TP-16. The Glacial Drift soils containing a higher silt content and the Highly/Moderately Weathered Bedrock tend to hold vertical-sided excavations without caving.

7.0 SLOPE STABILITY ANALYSIS

7.1 GENERAL

ICE completed global stability analysis along three critical sections as shown on Figure 2 where significant grading and retaining walls are planned. The three critical sections are summarized as follows:

Critical Section A-A’ – A 3H:1V cut slope up to 16-feet high into the existing slope is planned in the west part of Lots 15 through 20. Critical Section A-A’ was completed along this slope in the area of Lot 17**.** The global stability analysis for Critical Section A-A’ assumes that the base of the upper (west) cut slopes contains an interceptor drain as described in section **8.14.3** of this report.

Critical Section B-B’ – A cut is planned for construction of Road A where the new access road turns east at the south end of the right-of-way, requiring a retaining wall up to 8-feet high below an approximate 10-foot-high 2H:1V cut slope.

Critical Section C-C’ – Up to about 10 feet of fill will be placed along the north end of the north lots (Lots 7 through 15). The fill will be supported by a Structural Earth Wall (SEW) up to 6-feet high. Above the wall, the fill will be graded to create an approximate 8-foot-high 2H:1V slope, before leveling out within the area of the lots. **T**he global stability analysis for Critical Section C-C’ was modeled using a 2-foot wall embedment and a geogrid length equal to the height of the wall.

7.2 METHODOLOGY AND RESULTS

Global stability analysis was completed using the computer application Slide 6.0 (RocScience, Version 6.039, May 10, 2016). This computer application has the capability of comprehensive slope stability analysis along with sensitivity and probabilistic analysis. Global stability analysis was completed using the Morgenstern-Price Method (1967) under static and dynamic (seismic/earthquake) conditions.

Slope stability analysis requires reasonably accurate surface topographic information and an appropriate amount of subsurface data for which soil and groundwater (hydrogeologic) conditions can be confidently interpreted along with soil strength characteristics of the soils. The topographic information used for our analysis and cross-sections was a combination of LiDAR data obtained from the DNR Washington LiDAR Portal (https://lidarportal.dnr.wa.gov/) processed for 2-foot contour intervals using Esri ArcGIS 10.6 computer application, and the field topographic survey (True North, June 18, 2018).

Subsurface data used for our slope stability analysis included Test Pits TP-5, TP-7, TP-8, TP-9, TP-10 and TP-13. Soil strength parameters were determined based on laboratory testing of similar soils for comparable projects and our experience. The following is a summary of the soil strength parameters used in our analysis.

Soil Type	Moist Unit Weight (pcf)	Φ (degrees)	C (psf)
Weathered Soil	120	34	0
Glacial Drift and Highly Weathered Bedrock	120	35	200
Moderately Weathered Bedrock	140	40	800
Structural Fill	125	35	0
Existing Fill	120	30	0

pcf = pounds per cubic foot, psf = pounds per square foot

Peak ground acceleration = 0.41g (2018 International Building Code) based on Site Class D (stiff native soil profile); horizontal coefficient k_h = 0.205

Φ = angle of internal friction, C = cohesion

In stability analyses, the relative stability of a slope is expressed in terms of a Factor of Safety (FOS) against sliding for the most likely potential failure surface. A FOS of 1.0 corresponds to the conditions in which the resisting and the driving forces are equal (equilibrium conditions), and failure would theoretically be imminent as the result of a decrease in the resisting force or an increase in the driving force. A FOS greater than 1.0 indicates that the forces tending to resist sliding are greater than the forces tending to cause sliding. A minimum static FOS of 1.5 and dynamic (seismic) FOS of 1.1 are considered adequate.

The results of this analyses for static and seismic conditions (before and after site development) are summarized in the following table:

Critical Section	Slope Condition	FOS (static)	FOS (seismic)
A-A’	Before Development	2.65	1.44
	After Development	2.49	1.38
B-B’	Before Development	2.29	1.23
	After Development	2.67	1.83
C-C’	Before Development	4.48	1.65
	After Development	1.74	1.19

The Slide 6.0 output files for the global slope stability analysis included as Attachment A.

8.0 CONCLUSIONS AND RECOMMENDATIONS

8.1 GENERAL

Based on our field reconnaissance, test pit explorations and analyses, we conclude that residential structures may be supported on conventional reinforced concrete spread footings extending to the medium dense/stiff or better Glacial Drift or Highly/Moderately Weathered Bedrock (competent soils or bedrock), or on a pad of Structural Fill that extends to the competent soils or bedrock.

We do not expect that excavation dewatering will be necessary. Locally, groundwater seepage may be encountered, and we expect it can be handled by pumping from a sump within the trench.

We expect that trench shoring will be required to support excavations deeper than about 4 feet, such as for underground utility installation. If shoring is required, we expect that conventional trench shields can be utilized for most of this construction.

At this time, an open permanent cut slope up to about 16-feet high and sloping at about 3H:1V is proposed in the area of Lots 15 through 20. Our slope stability modeling suggests that this final slope configuration is safe. This modeling relies on a confident interpretation of subsurface conditions. We expect that groundwater seepage may emerge from the toe area or at the base of the cut slope. We strongly recommend a groundwater interceptor trench be installed at the base of the cut slope. Quarry spalls (3- to 8-inch diameter broken rock) may also need to be placed in lower part of the cut slope if groundwater seepage is observed to emerge from this area.

The site soils (Fill, Topsoil, Weathered Soil, Glacial Drift and Highly/Moderately Weathered Bedrock) are moisture sensitive. It will be preferable to construct the project during the normally drier months such as late spring through early fall to reduce earthwork-related costs. We expect that the excavated native soils, except the Topsoil and Weathered Soil containing abundant roots, if encountered, may be reused as general fill, excluding use as pipe bedding, and may require moisture conditioning (wetting or drying) in some instances to achieve adequate compaction. We expect that a water source will be necessary (water truck) to moisture condition trench backfill in local areas if the earthwork is done July, August or September.

It is important to implement appropriate temporary and permanent erosion controls for the site in accordance with local requirements. Conventional temporary erosion controls should be adequate provided they are properly installed and maintained. Permanent erosion protection must be accomplished promptly after completion of construction and must be maintained as necessary until the construction area is stabilized.

We recommend that a representative from ICE observe the earthworks aspects of the project and provide consultation, as needed, as a means to document the earthwork activities completed by the contractor and to assist the contractor in modifying their earthwork construction methods, as necessary, for adequate site preparation.

8.2 CRITICAL AREAS EVALUATION

8.2.1 Coal Mine Hazard Evaluation

As previously described, a preliminary coal mine hazard assessment has been completed for the Property as presented in ICE's report dated July 7, 2015. Based on the current development plan, the southeast half of Lot 2 and all of Lot 3 are within a Moderate Coal Mine Hazard Area as shown on Figure 3. The reminder of the Property is within a Declassified Coal Mine Area. No Severe Coal Mine Hazard Areas exist within the Property. Other than the southeast half of Lot 2 and all of Lot 3 which are within a Moderate Coal Mine Hazard Area, no other lots or significant structures are to be developed or constructed within Moderate or Severe Coal Mine Hazard Areas.

ICE's July 7, 2015 report provides the following recommendations for residential development within a Moderate Coal Mine Hazard Area.

- Use of rigid foundations (conventional reinforced concrete spread footings) supporting a flexible superstructure (wood-frame).
- Small, square or nearly square-shaped building pads should be favored over large, irregularly-shaped building pads.
- Crawl-space construction rather than slab-on-grade. However, slab-on-grade may be used in garage and driveway areas.
- Buildings should be constructed such that they could be easily releveled.
- No brick or basement construction.
- Edges of foundations should be backfilled with loose soil or other compressible material to allow for potential ground compression.
- Underground utilities should be designed with flexible and/or telescopic couplings or fittings.
- Utilities that depend on gravity for flow (sewers and storm drain) should be designed to compensate for the potential for ground subsidence.

8.2.2 Steep Slope Hazard Evaluation

The Property contains Steep Slope Hazard Areas as defined by IMC Chapter 18.10.390; these areas are labeled as Slopes 1, 2, 3, 4 and 5 on Figure 3.

Slope 1 – In our opinion, Slope 1, a fill slope greater than 40 percent grade and up to about 12-feet high located west of the Property as shown on Figure 3, is due to previous grading on the adjacent residential property. This area appears to be stable in its current condition. We completed a global stability analysis through this slope (Critical Section A-A'); the output files are included in Attachment A. Based on our observations and analysis, we recommend that this area be **exempt from Steep Slope Hazard Area regulation** (IMC 18.10.580 E.1 and E.2).

Slopes 2 and 3 – Slope 2, located west of Lots 1, 2 and 3 along the ravine slope east of Mine Hill Creek, exceeds 40 percent grade (average 60 to 80 percent grade along full slope height) and is up to about 19-feet high. Slope 3 (two separate slopes) located along the ravine slope west of Mine Hill Creek, exceeds 40 percent grade (average 40 to 75 percent grade or full slope height) and is up to about 16-feet high. The slopes were observed to be dry, generally planar, well vegetated with no soil exposures. In addition, we observed stable channel conditions and shallow bedrock observed along the ravine slopes and within Test Pit TP-2 directly east of the ravine. Based on our observations of stable slope conditions, it is our opinion that Slopes 2 and 3 are stable in their existing condition and should be **exempt from Steep Slope Hazard Area regulation** (IMC 18.10.580 E.1).

Slope 4 – Slope 4 (two adjacent slope areas) located north of the existing driveway along the ravine slope west of Mine Hill Creek, exceeds 40 percent grade (average 40 to 70 percent grade for full slope height) and is up to about 12-feet high. The toe of the slopes have been oversteepened due to grading for the existing driveway. Based on our site observations of dry planar slopes with straight mature conifer trees and no bare soil or evidence for erosion along these slopes, it is our opinion that Slope 4 is stable in the existing condition and should be **exempt from Steep Slope Hazard regulation** (IMC 18.10.580 E.1).

Slope 5 – Slope 5 is a Steep Slope Hazard Area that is about 16-feet high located in the center of Tract A as shown on Figure 3; Slope 5 **should <u>not</u> be exempt**. The area upgradient of this Steep Slope Hazard Area contains seepage and is likely unstable if modified **For Slope 5, we recommend that a buffer be applied that is measured from the edge of the surrounding Landslide Hazard Area (shown as the crosshatched area on Figure 3) where seepage was observed as described in the section below.**

8.2.3 Landslide Hazard Evaluation

A Landslide Hazard Area (as defined in IMC Chapter 18.10.390.B.1, B.2 and B.3) exists along the ravine slope west of Mine Hill Creek where seepage was observed on slopes between 15 and 40 percent grade as shown on Figure 3 (crosshatched area); the Landslide Hazard Area also includes the area of Slope 5. It appears that the seepage is related to emerging groundwater within the somewhat permeable Glacial Drift soils that overlie less permeable Renton Formation bedrock. We observed Renton Formation bedrock downgradient of this seepage area along Slope 5. **We recommend a buffer of 15 feet from the edge of the crosshatched Landslide Hazard Area as shown on Figure 3.**

The exempt Steep Slope Hazard Areas described in the previous section are also Landslide Hazard Areas (per IMC Chapter 18.10.390.A). Alterations to Landslide Hazard Areas *located on a slope forty (40) percent or steeper shall be altered only as allowed under standards for steep slope hazard areas* (IMC Chapter 18.10.560.C.1) and are exempt based on the conclusions in the previous section.

8.2.4 Erosion Hazard Evaluation

Based on the NRCS mapping, the soils underlying the Property are Kitsap silt loam (KpC for slopes between 8 and 15 percent and KpD for slopes 15 to 30 percent). Kitsap silt loam is characterized as having a severe erosion hazard. The entire Property is located within an Erosion Hazard Area. Mitigation of Erosion Hazard Areas should be implemented as described in section **8.15** of this report.

8.2.5 Seismic Hazard Evaluation

Based on our test pit explorations, the soils underlying the Property are not susceptible to seismically-induced settlement or soil liquefaction. Groundwater was observed as a relatively thin zone, perched on cohesive, low permeability soils (Glacial Drift and Highly/Moderately Weathered Bedrock) typically in a medium dense to dense/stiff to very stiff condition. Based on these observations, it is our opinion that the potential for seismically-induced settlement or soil liquefaction is very low within the Property.

No Seismic Hazard Areas are located within the Property.

8.3 SITE PREPARATION

Topsoil and Weathered Soil containing abundant roots should be stripped and grubbed from the proposed development area. These areas of stripping and grubbing should be limited to areas of active grading in a phased manner. We expect the stripping depth and grubbing to be about 1 to 2 feet during dry weather conditions. Greater stripping and grubbing depths may be encountered where abundant organic material is present to greater depths and where houses or other buildings are demolished.

Foundation elements, underground utilities and septic tank/drainfield related to the existing houses should be removed. Roots larger than 1-inch diameter should be grubbed to at least 12 inches below the design subgrade.

Soil stripped from the site can be removed or used in landscape (non-structural) areas.

Following clearing, stripping and grubbing, the exposed subgrade should be thoroughly proofrolled in dry weather and probed in wet weather to identify areas of soft, loose or otherwise unsuitable subgrade areas. Soft or loose soils identified as unsuitable soils during proofrolling or probing in structure areas should be completely removed and replaced with Structural Fill. Partial removal of the unsuitable soil could be considered on a case-by-case basis. In pavement areas, the unsuitable soil should be removed to a depth of at least 3 feet. Where soft, loose or wet soils are present below 3 feet, we recommend that a woven geotextile fabric, such as Tencate Mirafi® RS580i or equivalent, be placed in the bottom of the excavation prior to backfilling with Structural Fill.

8.4 STRUCTURAL FILL

Structural Fill should be free of organic material or debris and have a maximum particle size of 4 inches. The material should contain less than five percent fines (soil passing the US Standard No. 200 sieve) by weight relative to the portion finer than the ¾-inch sieve. If earthwork is done during generally dry weather conditions, the fines content may be increased.

As a guideline, Structural Fill should be placed in horizontal lifts which are 10 inches or less in loose thickness. The actual lift thickness depends on the quality of the fill material and the size of the compaction equipment.

We recommend that Structural Fill placed in the building, parking and access areas be uniformly compacted using mechanical equipment (wheel rolling is not acceptable) to at least 95 percent of the maximum dry density (MDD - in general accordance with ASTM Test Method D 1557 when referred to in this report). Nonstructural fill placed in landscape areas need only be compacted to the degree required for trafficability of construction equipment and effective surface drainage.

We expect that the Weathered Soil that does not contain abundant roots, Glacial Drift and Highly/Moderately Weathered Bedrock that are excavated may be reused for Structural Fill during periods of extended dry weather. During wet weather, it may be necessary to import soil containing less than five percent fines (soil particles passing the US Standard No. 200 sieve).

8.5 CUT AND FILL SLOPES

8.5.1 General

In general, the stability of cut or fill slopes is largely dependent on the management of surface water runoff and groundwater seepage. For this purpose, the basis of our conclusions and recommendations is that surface and groundwater is adequately managed for cut and fill slopes. If groundwater seepage in permanent cut or fill slope areas is encountered during or after construction, ICE should be contacted immediately to evaluate these conditions.

8.5.2 Fill Slopes

Structural Fill slopes may be sloped at 2H:1V or flatter. All surfaces which will receive fill should be properly stripped of vegetation and organic material prior to placing fill. Fill placed on existing slopes which are steeper than 4H:1V should be properly keyed into the native slope surface. This can be accomplished by constructing the fill in a series of 4- to 8-foot-wide horizontal benches cut into the slope. The fill should be placed in horizontal lifts.

Abrupt transitions between cut and fill road sections may result in damage to the road. Therefore, we recommend that all cut/fill transition zones be graded so that the fill thickness does not increase by more than 2 feet within a 10-foot horizontal distance within 20 feet of the cut/fill transition line.

8.5.3 Cut Slopes

Temporary cuts less than 4 feet in height may be made near-vertical in competent soil. Temporary cuts greater than 4 feet in height may be made at 1H:1V or flatter. Permanent cut slopes should be inclined no steeper than 2H:1V.

At this time, an open permanent cut slope up to 16-feet high and slopes at about 2H:1V is proposed along the west side of Lots 16 through 20. Our slope stability modeling suggests that this final slope configuration is safe. This modeling relies on a confident interpretation of subsurface conditions. We expect that groundwater seepage may emerge from the toe area or at the base of the cut slope. We strongly recommend a groundwater interceptor trench be installed at the base of the cut slope. Quarry spalls (3- to 8-inch diameter broken rock) may also need to be placed in lower part of the cut slope if groundwater seepage is observed to emerge from this area.

8.6 FOUNDATION SUPPORT

8.6.1 General

The proposed buildings may be satisfactorily supported on conventional reinforced concrete spread footings provided that they are constructed in accordance with the recommendations outlined below.

8.6.2 Spread Footings

We recommend that spread footings be founded on medium dense/stiff or better native undisturbed soils or bedrock (Glacial Drift and Highly/Moderately Weathered Bedrock) or on a pad of Structural Fill that extends to the competent native soils or bedrock. In areas where Structural Fill is placed under footings, the zone of Structural Fill below footings should extend laterally beyond the footing edges a horizontal distance at least equal to the thickness of the Structural Fill placed.

Continuous and isolated spread footings should have minimum widths of 16 and 24 inches, respectively.

The footings should be a minimum of 24 inches below the adjacent grade for frost protection. Footings may be designed using an allowable soil bearing value of 2,000 psf. This value applies to the sum of all dead and long-term live loads, exclusive of the weight of the footing and the backfill above the footing. For transient loads, including wind or seismic, a one-third increase in the recommended value may be used.

Care should be taken to avoid loosening or softening the bearing surface soils when preparing footing subgrades, particularly during wet weather. During wet weather, foundations should be excavated, formed and poured the same day or be protected by a layer of crushed rock or lean concrete. We estimate that settlement of footings founded as described will be less than ½ inch and will occur rapidly as loads are applied.

Resistance to lateral loads can be developed by friction between the base of the foundation and by passive pressures acting on the sides of foundations. We recommend that resistance to lateral loads be estimated using a coefficient of friction of 0.3 and an equivalent fluid density of 200 pcf. These values include a FOS of 1.5.

8.7 SLAB SUPPORT

The slab-on-grade subgrade should be prepared in accordance with section **8.3** of this report. We recommend that the subgrade surface be compacted such that a minimum compaction of 95 percent of the MDD is achieved before placing Structural Fill or capillary break material.

We recommend that a layer of medium to coarse sand and gravel at least 4-inches thick containing less than three percent fines (material passing the US Standard No. 200 sieve) by weight based on the fraction of the material passing the ¾-inch sieve be placed below the bottom elevation of the floor slab to provide uniform support and a capillary break. A vapor barrier and/or waterproofing should be provided if there is a potential for surface or shallow groundwater to occur or migrate under the slab.

8.8 SUBGRADE (BASEMENT) WALLS

Subgrade (basement) walls may be required for house construction. It is essential that footing and curtain drains are property installed to provide for a dry basement. Footing drains are described in section **8.14.2** of this report.

The lateral soil pressures acting on subgrade walls depend on the type, density and geometry of the soil behind the wall and the amount of lateral wall movement which can occur as backfill is placed. For walls that are free to yield at the top at least one one-thousandth of the height of the wall, an active pressure obtained using equivalent fluid densities of 35, 45, and 60 pcf should be used for level backslopes, 4H:1V backslopes and 2H:1V backslopes, respectively. These values assume that the soil behind the wall is free draining. For "at rest" conditions where the wall is restrained against movement, a lateral pressure based on equivalent fluid densities of 50, 55, and 75 pcf should be used for level backslopes, 4H:1V backslopes and 2H:1V backslopes, respectively. These values assume that the soil behind the wall is free draining. Surcharge effects should be considered as appropriate.

In settlement-sensitive areas, the backfill for subgrade walls should be compacted to at least 95 percent of the MDD. At other locations, wall backfill should be compacted to between 90 and 92 percent of the

MDD. Measures should be taken to prevent the buildup of excess lateral soil pressures due to overcompaction of the backfill behind the wall.

A drainage zone (curtain drain) consisting of clean, free-draining granular material as described in the 2020 Washington State Department of Transportation Standard Specifications for Road, Bridge, and Municipal Construction (WSDOT Standard Specifications) section 9-03.12(2) (*Gravel Backfill for Walls*) although the fines content (soil particles passing the US Standard No. 200 sieve of less than 3 percent (rather than 5 percent) should be used. The curtain drain should be at least 18-inches wide should be placed against the back face of the wall for its full height. Positive drainage behind subgrade walls should also include installing a footing drain at the base of the wall as described in section **8.14.2** of this report. **A drainage composite, such as MiraDRAIN can be used, but not as a replacement for the curtain drain.**

8.9 UNDERGROUND UTILITY CONSIDERATIONS

8.9.1 Trench Excavation

The Fill, Alluvium, Weathered Soil, Glacial Drift and Highly/Moderately Weathered Bedrock can be excavated using conventional heavy construction equipment such as a Hitachi EX450LC track-mounted excavator. The Highly/Moderately Weathered Bedrock becomes increasingly dense with greater depth (more than 5 feet into the Highly/Moderately Weathered Bedrock) where mechanical chipping may be needed to loosen the bedrock.

We understand that installation of utilities within the Tract A utility easements may require excavations up to about 19-feet deep for the sanitary sewer and up to about 14-feet deep for the stormwater vault outlet pipe.

8.9.2 Excavation Cut Slopes

Temporary cuts greater than 4 feet in depth in Weathered Soil, Glacial Drift or Highly/Moderately Weathered Bedrock may be made at an inclination of 1H:1V or flatter. Flatter slopes may be necessary if instability is observed.

Some sloughing and raveling of the cut slopes should be expected. Temporary covering, such as heavy plastic sheeting, should be used to protect these slopes during periods of wet weather. Surface water runoff from above cut slopes should be prevented from flowing over the slope face by using berms, drainage ditches, swales or other appropriate methods.

If temporary cut slopes experience excessive sloughing or raveling during construction, it may become necessary to modify the cut slope inclinations to maintain safe working conditions and protect adjacent facilities or structures. Slopes experiencing problems can be flattened or regraded to add intermediate slope benches if poor slope performance is encountered. Alternatively, underground utility trenches can be completed using temporary trench shoring (shored excavations) in lieu of cut slopes.

All temporary cut slopes must comply with the provisions of Title 296 Washington Administrative Code (WAC), Part N, “Excavation, Trenching and Shoring.” We recommend that cut slopes for temporary excavations be made the responsibility of the contractor. The contractor is present at the site continuously and is best able to observe changes in site and soil conditions and monitor the performance of excavations.

8.9.3 Shored Excavations

To construct the underground utilities, it will be necessary to support the temporary excavations to maintain the integrity of the surrounding undisturbed soils, reduce disruption of adjacent areas, as well as to protect the personnel working within the excavations.

Because of the diversity of available shoring systems and construction techniques, the design of temporary shoring is most appropriately left up to the contractor proposing to complete the installation. We recommend that the shoring be designed by a licensed professional engineer in Washington, and that the PE-stamped shoring plans and calculations be submitted to the project engineer for review and comment prior to construction. The following paragraphs present recommendations for the types of shoring systems and design parameters that we conclude are appropriate for the subsurface conditions at the Property.

The majority of the materials within the project area can be retained using conventional trench shoring systems such as trench shields or sheet piles, with lateral restraint. The design of temporary shoring should allow for lateral pressures exerted by the adjacent soil, and surcharge loads due to traffic, construction equipment, and temporary stockpiles adjacent to the excavation, etc. Lateral load resistance can be mobilized through the use of braces, tiebacks, anchor blocks and passive pressures on members that extend below the bottoms of excavations. Temporary shoring utilized to support excavation walls typically use internal bracing such as aluminum hydraulic shoring or trench shield bracing.

Temporary trench shoring with internal bracing can be designed using active soil pressures. We recommend that temporary shoring be designed using a lateral pressure equal to an equivalent fluid density of 40 pcf, for conditions with a level ground surface adjacent to the excavation. If the ground within 5 feet of the excavation rises at an inclination of 1H:1V or steeper, the shoring should be designed using an equivalent fluid density of 75 pcf. For adjacent slopes flatter than 1H:1V, soil pressures can be interpolated between this range of values. Other conditions should be evaluated on a case-by-case basis.

These lateral soil pressures do not include traffic or construction surcharges that should be added separately, if appropriate. It is typical for shoring to be designed for a traffic influence equal to a uniform lateral pressure of 100 psf acting over a depth of 10 feet below the ground surface. More conservative pressure values should be used if the designer deems them appropriate. These soil pressure recommendations are predicated upon the excavation being essentially dewatered; therefore, hydrostatic water pressures are not included.

Shoring must comply with the provisions of Title 296 Washington Administrative Code (WAC), Part N, "Excavation, Trenching and Shoring." As previously described, we recommend that the design of shoring be made the responsibility of the contractor. The contractor is present at the site continuously and is best able to observe changes in site and soil conditions and monitor the performance of excavations.

8.9.4 Trench Backfill

Trench backfill should consist of Structural Fill quality material. Structural Fill material should be free of debris, organic material and rock fragments larger than 6 inches. Unless specified otherwise in this report, the following general requirements shall apply to fill placement, including pipe bedding, and trench backfilling.

- Underground utilities should be bedded in crushed gravel as specified in the 2020 WSDOT Standard Specifications, section 9-03.12(3) (*Gravel Backfill for Pipe Zone Bedding*).
- Pipe zone bedding should be extended at least 4 inches below the utility line and 6 inches above the utility line. Bedding should be worked under the pipe haunches using hand tools as required. Bedding material should be tamped or vibrated (compacted) into place.
- Pipe zone bedding for non-water underground utilities should be compacted to at least 90 percent of the MDD. Pipe zone bedding for all water mains should be compacted to at least 95 percent of the MDD.
- Backfill placed above the bedding material should consist of Structural Fill quality on-site material, or *Common Borrow* as specified in 2020 WSDOT Standard Specifications, section 9-03.14(3). During wet weather periods, backfill material should have less than five percent fines content.
- As a guideline, backfill should be placed in lifts of 10 inches or less (loose thickness). Each lift should be compacted prior to placing the subsequent lift. Prior to compaction, the backfill should be moisture conditioned to near optimum moisture content. The loose lift thickness should be a field decision by a representative from ICE.
- Trench backfill should be compacted in lifts to at least 95 percent of the MDD obtained in general accordance with ASTM Test Method D 1557. Backfill compaction should be achieved by mechanical means. No jetting, ponding, or flooding will be allowed for compaction.
- During trench backfill placement, in-place density tests should be completed at approximately 100-foot intervals along the trench alignment to evaluate if the required compaction is being achieved.

8.9.5 Settlement Considerations

We expect that the underground utilities will generally be deep enough (more than 4-feet deep) so that the utility and bedding pipe will be founded on firm bearing soils. Nominal settlements will occur under these circumstances with good construction practices.

Localized exceptions will be in the areas where the pipe invert is underlain with very loose or soft soils. However, based on our test pit explorations and general knowledge of the site conditions, we do not expect these very loose or soft soil conditions to be a persistent problem. Should these conditions be encountered, long-term settlement could occur from the pipe and bedding material in these areas, and construction difficulties during installation with the very loose or soft ground could result in additional settlement. Under these circumstances, we recommend the very loose or soft soils be removed to a depth equal to the diameter of the pipe plus 12 inches to each side. We recommend that a woven geotextile such as Tencate Mirafi® S380i / RS580i, or equivalent, be placed in the base of the overexcavation to reduce the potential for contamination of the pipe bedding. The overexcavation should be backfilled with bedding soils as described in the previous section of this report. Settlements are expected to be nominal using this procedure.

8.9.6 Slope Stability

Buried utilities, including water and sanitary sewer and stormwater drainage are proposed within the utility easements adjacent to or crossing Steep Slope Hazard Areas (Slopes 3 and 4). As previously described, we recommend that these areas be exempt from Steep Slope Hazard Area regulations.

Based on information provided by Mr. Joudi regarding the planned burial depth of the utilities within the easements, we understand that the sanitary sewer main will be up to about 19-feet deep (above Slope 3) and between about 5- and 10-feet deep at the base of Slope 4. The water main will be about 3- to 5-feet deep in these areas. The stormwater vault outlet pipe will be up to about 14-feet deep above and along Slope 4.

It is our opinion that installation of the utilities at the top or base of these slopes will not destabilize the existing slope conditions, provided that the following recommendations are followed:

- Trenching should be completed during the summer or early fall months (June through October).
- Only open up a length of trench that can be backfilled in the same day.
- Recommendations for construction dewatering (section **8.10** of this report) should be followed If groundwater is encountered.

8.10 CONSTRUCTION DEWATERING

The subsurface information for the Property suggests that site soils have a wide range of permeability. We do not expect high rates of water infiltration into the excavations. However, because of the complexity of the surficial soils and the underlying bedrock, localized areas of groundwater may be encountered.

Several dewatering methods, if needed, would be appropriate for this project. These methods include open (sump) pumping or well points. We expect that open pumping will be the method used to achieve dry working conditions in most areas of the Property.

In our opinion, the contractor should be responsible for designing and installing the appropriate dewatering system needed to complete the work for the Property. We recommend that the contractor be required to submit the proposed dewatering system design and plan layout to the project engineer for review and comment prior to beginning construction. Water collected during dewatering should be disposed of appropriately and may require special permits for this purpose.

8.11 ACCESS ROADS

8.11.1 Structural Fill

New fill for the access road (including the new road extending south from the west end of Clark Street SW and Road A/Road B) should be placed as Structural Fill as described in section **8.4** of this report. We recommend that a representative from our firm observe the preparation for, placement, and compaction of Structural Fill. An adequate number of in-place density tests should be completed in the fill to evaluate if the desired degree of compaction is being achieved.

8.11.2 Road Subgrade Preparation

We expect that the access roads will initially experience repeated traffic from heavy construction equipment and trucks. The heavy equipment loads require that the subgrade preparation be effective. Lack of adequate subgrade preparation and protection of the subgrade might result in severe damage to the access road subgrade and surfacing due to construction traffic.

Prior to placing the base course materials, we recommend that the exposed subgrade be thoroughly prepared and evaluated as recommended in section **8.3** of this report. A representative from ICE should be present to observe pavement subgrade preparation and advise on the extent of any remedial action needed.

8.11.3 Road Drainage Considerations

Portions of the access roads may expose soil with a high fines content that is susceptible to frost heaving. Due to the possibility of variable subgrade conditions along the access roads and concerns regarding frost heave damage to the road surface, in our opinion it is important that adequate drainage be provided below the pavement.

For long-term stability of the pavement section, the surfacing should be underlain by an adequate layer (typically 6-inches thick) of free-draining sand and gravel (subbase) to act as a capillary break. ICE can assist in developing a pavement section upon request.

8.12 SLOPE SUPPORT OPTIONS

8.12.1 General

A retaining wall up to 8-feet high is planned at the west end of Road A. A second retaining wall (possibly a structural earth wall) up to 6- feet high is planned along the north side of Lots 6 through 14. The types of retaining walls have not been determined; we assume conventional reinforced concrete walls (for basement construction), structural earth walls or gravity block wall systems may be used.

The following paragraphs provide general descriptions of possible slope support options, along with general design guidelines for these slope support options. Additional subsurface exploration (especially for a soldier pile wall), consultation and analysis may be required depending on the wall application requirements. ICE should be retained to review wall design plans and observe the earthwork aspects of wall construction.

8.12.2 Reinforced Concrete Retaining Walls (Basement Walls)

Reinforced concrete retaining walls may be used to retain fills or cuts where competent foundation soils exist within a reasonable foundation excavation depth. The specific wall design values depend on many factors such as wall height, backslope inclination, and soil and groundwater conditions. Reinforced concrete retaining walls should be founded on the native medium dense/stiff or better soils, Highly/Moderately Weathered Bedrock or Structural Fill compacted to at least 95 percent of the MDD . For walls placed where the ground surface slopes downward from the base of the wall, we recommend that a horizontal setback distance equal to twice the footing width be maintained from the near edge of the footing to the slope face.

The following describes general geotechnical design parameters for reinforced concrete retaining walls:

- For walls that are free to yield at the top at least one one-thousandth of the height of the wall, an active pressure of 35 pcf should be used for a level backslope. This value assumes that the soil behind the wall is free-draining.
- For "at rest" conditions, an active pressure of 50 pcf should be used for level backslopes. This value assumes that the soil behind the wall is free-draining.
- The effective wall height used to calculate active lateral pressures should be increased by 1 foot for each 100 psf of surcharge load.
- For footings founded on native medium dense/stiff or better soils, including Highly/Moderately Weathered Bedrock or Structural Fill compacted to at least 95 percent of the MDD, the allowable frictional resistance may be computed using a coefficient of friction of 0.4 applied to the dead load forces.

- The allowable passive resistance on the sides of footings cast neat against undisturbed native soils, bedrock or on Structural Fill may be computed using an equivalent fluid density of 300 pcf.
- The above coefficient of friction and passive equivalent fluid density values both include a FOS of about 1.5.
- Backfill in the zone behind the wall for a distance of at least 2 feet should consist of clean (less than five percent fines) sand and gravel.
- The sand and gravel should be compacted to about 92 percent of the MDD to within 2 feet of finished grade, and to at least 95 percent of the MDD above this level.
- Lightweight compaction equipment should be used within 5 feet of the walls.
- A 4-inch diameter rigid, perforated drainpipe should be installed at the outside base of the perimeter footing of the walls.
- The perforated drainpipe should be embedded in a zone of coarse sand and gravel containing less than three percent fines.
- The drainpipe should be connected to a tightline system leading to a suitable discharge and away from slope areas.

8.12.3 Structural Earth Walls

SEWs are an economical means of retaining fills up to 20 feet or more high. They are generally not cost-effective for cuts where soil must be excavated to allow placement of the reinforcement strips (geogrids). Geogrids are embedded in the compacted fill as the level of the fill is raised. The geogrids effectively stabilize a large mass of soil by developing friction between the grids and the soil and increasing the shear strength of the mass. The face of the reinforced fill may be nearly vertical if it is covered with architectural blocks that are integral with the grids.

Well-drained granular soils are best suited for use as reinforced fill when constructing a SEW. The on-site soils contain a relatively high percentage of fines and will not be suitable for use in the reinforced fill zone. We recommend that the reinforced fill consist of material described in section 9-03.12(2) of the WSDOT 2020 Standard Specifications section 9-03.12(2) (*Gravel Backfill for Walls*).

A minimum embedment of 2 feet (deep embedment necessary for slope stability) should be used for the wall blocks, assuming that the adjacent grade is level. If the adjacent grade is sloped, the wall should be additionally embedded until the face of the wall footing is at least 6 feet horizontally from the face of the slope.

Wall footings bearing on undisturbed native soils, Weathered Bedrock or Structural Fill as described previously can be designed using an average allowable bearing value of 2,500 psf with a maximum toe pressure of 3,500 psf, when the adjacent downhill slope is 4H:1V or flatter. Passive resistance on the embedded portion of the wall should be assumed to be zero. Final design values for length and spacing of the grids should be specified by the geogrid system manufacturer.

Based on our global stability analysis (Critical Section C-C'), the retaining wall system at the north end of Lots 6 through 14 should be designed as a SEW with the design parameters (embedment depth, geogrid length) as outlined in section 7.1 of this report.

8.12.4 Gravity Block Walls

Gravity Block Walls (GBWs) are well suited for slope support where a cut is required and there is insufficient space for an open, cut slope. The GBW system relies on mass and weight for providing lateral stability of a cut into a slope. ICE can provide design details for a GBW if used.

A GBW (Redi-Rock® example) consists of several components as described below.

Redi-Rock® Blocks – Three block sizes are available including 28-, 41- and 60-inch blocks that are installed with the long dimension perpendicular to the slope. Full blocks are typically 46.5-inches wide and 18-inches high and vary in weight from about 1,750 to 3,420 pounds. Blocks can be installed with a batter of 0.010-inches, 0.375-inches, 1.675-inches and 9.375-inches per block.
Drainage Fill / Drainage Composite – Drainage Fill consists of free-draining aggregate, such as 2020 WSDOT Standard Specifications section 9-03.9(2) (*Permeable Ballast*), that is placed behind the Redi-Rock® blocks. If a Drainage Composite, we recommend combining the Drainage Fill and Drainage Composite. The Drainage Composite is not a substitute for the Drainage Fill, however, Drainage Fill alone is satisfactory.
Retained Soil – The native soil where cuts are made into existing slopes.
Leveling Pad / Wall Foundation – Compacted and free-draining crushed rock such as the 2020 WSDOT Standard Specifications section 9-03.9(3) (*Top Course*) pad upon which the Redi-Rock® blocks are placed.
Embedment – The minimum depth (1 foot) to which the base Redi-Rock® block is embedded into the ground.
Foundation Subgrade – Medium dense or better, existing fill or native soil, or Structural Fill that extends to the competent native soils.
Drain Pipe – 4-inch diameter, smooth-walled perforated plastic pipe placed at the base of the wall that discharges by gravity to a suitable location.
Geotextile Filter Fabric – A non-woven geotextile fabric, such as TenCate Mirafi® 160N or equivalent, which is placed between the Retained Soil and the Drainage Fill.
Backslope – The ground surface slope behind (uphill from) the wall.
Foreslope – The ground surface slope in front of the wall.
Batter – The horizontal offset between subsequent Redi-Rock® blocks, decreasing the inclination of the wall face.

8.13 STORMWATER DETENTION VAULT AND OUTLET PIPE

We expect that the stormwater detention vault structure will be supported on undisturbed Glacial Drift or the Moderately Weathered Bedrock in a medium dense/stiff or better condition. We estimate that settlement of the vault structure will be less than 1 inch using an allowable bearing pressures of 5,000 psf (assuming a burial depth of at least 8 feet). Settlements are expected to occur rapidly as loads are applied.

Backfill around the vault structure should be placed in horizontal lifts with a maximum loose thickness of about 8 inches and compacted to at least 90 percent of the MDD. Only hand-operated compaction equipment should be permitted within 5 feet of the vault structure walls to avoid excessive lateral pressures on the walls.

For backfill placed as described, we recommend using a design lateral pressure imposed by an equivalent fluid weighing 55 pcf. The design lateral pressure is based on maintaining drained conditions in the soils surrounding the vault structure. If a drainage system cannot be provided at the base of the vault structures, we recommend designing the stormwater detention vault structure for a lateral pressure resulting from an equivalent fluid weighing 90 pcf from a depth of 2 feet below the ground surface to the bottom of the vault. A rectangular pressure equal to 0.45 times the weight of superimposed dead or live loads at the surface should be added where present.

Uplift forces could develop on the stormwater detention vault structure when the water level in the surrounding soils is high and the structure contains little or no stormwater. Uplift forces can be resisted by weight of the structure and any overlying backfill.

The stormwater detention vault is designed with an outlet on the east side of the vault. We understand that two options have been proposed for disposal of stormwater from the detention vault, including 1) dispersing the stormwater along the top of the slope at the outlet location, or 2) conveying the stormwater by a buried tightline pipe (stormwater vault outlet pipe as shown on Figure 2) to the base of the ravine slope where the stormwater will be dispersed along a rip rap pad near Mine Hill Creek.

Based on our observations, shallow soils at and downgradient from the stormwater detention vault outlet location have little to no potential for infiltration; shallow soils in this area (Test Pits TP-3 and TP-15) consist of low permeability Glacial Drift. It is our opinion that dispersing the stormwater at the outlet location could lead to significant erosion and potential slope instability. The more favorable option is the installation of the stormwater vault outlet pipe that would allow the stormwater to be dispersed at the base of the slope as shown on Figure 2.

8.14 DRAINAGE CONSIDERATIONS

8.14.1 General

It is important that appropriate permanent drainage measures be provided for the project. In our opinion, these drainage measures should consist of footing drains and interceptor drains. Also, surface water runoff should be adequately handled. We recommend sloping the ground surface away from buildings. Drainage measures for site development need to be planned such that discharge of stormwater does not occur in the Steep Slope Hazard Areas (exempt or regulated).

8.14.2 Footing Drains

Footing drains should be provided for the exterior footings of the houses. These drains should consist of a 4-inch-diameter rigid (smooth-wall), perforated drainpipe installed at the outside base of the perimeter footing. The perforated drainpipe should be embedded in a zone of coarse sand and gravel containing less than three percent fines. The drainpipe should be connected to a tightline system leading to a suitable discharge at appropriate intervals such that water backup does not occur. The footing drains should be independent from the roof drains.

Basement walls should be similarly designed and constructed with a footing drain. The zone of washed rock should extend the full height of basement walls (referred to as a “curtain drain”).

8.14.3 Interceptor Drains

Interceptor drains should be installed the full length at the base of the 3H:1V cut slope that is proposed in the west part of Lots 15 through 20.

The interceptor drain trenches should be at least 24-inches wide and 4-feet deep but may be shallower or deeper depending on the conditions encountered during grading. The base and sides of the interceptor drain trench should be lined with nonwoven geotextile fabric such as Tencate Mirafi® 140N, or equivalent. No fabric should be placed over the top of the trench backfill. It is important that the filter fabric not be placed in a muddy trench to avoid filling the pore spaces with mud and plugging the fabric.

Interceptor drains should consist of a zone of clean free-draining coarse sand and gravel containing less than three percent fines. Smooth-wall perforated drainpipe having a minimum diameter of 4 inches should be embedded within this zone of coarse sand and gravel consistent with the 2020 WSDOT Standard Specifications section 9-03.12(2) (*Gravel Backfill for Walls*) with the fines (No. 200 sieve) reduced to less than three percent. The drainpipe should be installed with the perforations down and should be sloped to drain. At appropriate intervals, the perforated drainpipe should be connected to a tightline leading to the stormwater collection system for the site. Cleanouts should be installed at appropriate intervals.

8.14.4 French Drains

French drains may be designed and installed to provide better drainage, especially in lawn and landscape areas. A French drain typically consists of a 2-foot wide by 2-foot deep trench with a perforated drain using 4-inch diameter smooth-walled PVC pipe embedded in uniform 1 inch washed round rock. Without this French drain system, these areas may be intermittently saturated during the wet season. The layout of French drains should be a field decision during construction.

8.15 EROSION CONTROL

The native surficial soils at the Property have a high potential for erosion. Erosion control measures should include proper control of surface water runoff, use of straw bales or appropriate geotextile filters and temporary sedimentation basins. Erosion control measures should comply with local requirements and guidelines which will likely include a condition for a Temporary Erosion and Sediment Control (TESC) plan. Water runoff from the work area should be diverted toward vegetated areas for dispersion to avoid sediment delivery to the stream. Disposal of surface water should be completed in accordance with local Best Management Practices (BMPs) as approved by the permitting agency.

9.0 USE OF THIS REPORT

We have prepared this revised report for use by Boardwalk Real Estate LLC. The data and report should be provided to prospective contractors for their bidding or estimating purposes, but our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

If there are changes in the grades, locations, configurations or types of the facilities planned, the conclusions and recommendations presented in this report may not be applicable. If design changes are made, we request that we be given the opportunity to review our conclusions and recommendations and to provide a written modification or verification. When the design has been finalized, we recommend that the final design and specifications be reviewed by our firm to see that our recommendations have been interpreted and implemented as intended.

There are possible variations in subsurface conditions between the explorations and also with time. A contingency for unexpected conditions should be included in the budget and schedule. Sufficient observation, testing and consultation by our firm should be provided during construction to evaluate whether the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions encountered during the work differ from those anticipated, and to evaluate whether or not earthwork and foundation installation activities comply with contract plans and specifications.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in this area at the time the report was prepared. No warranties or other conditions, express or implied, should be understood.

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We trust this revised report meets your present needs. Please call if you have any questions.

Yours very truly,
Icicle Creek Engineers, Inc.

Jeffrey M. Schwartz, LEG, LHG
Project Engineering Geologist/Hydrogeologist

Brian R. Beaman, PE, LEG, LHG
Principal Engineer/Geologist/Hydrogeologist

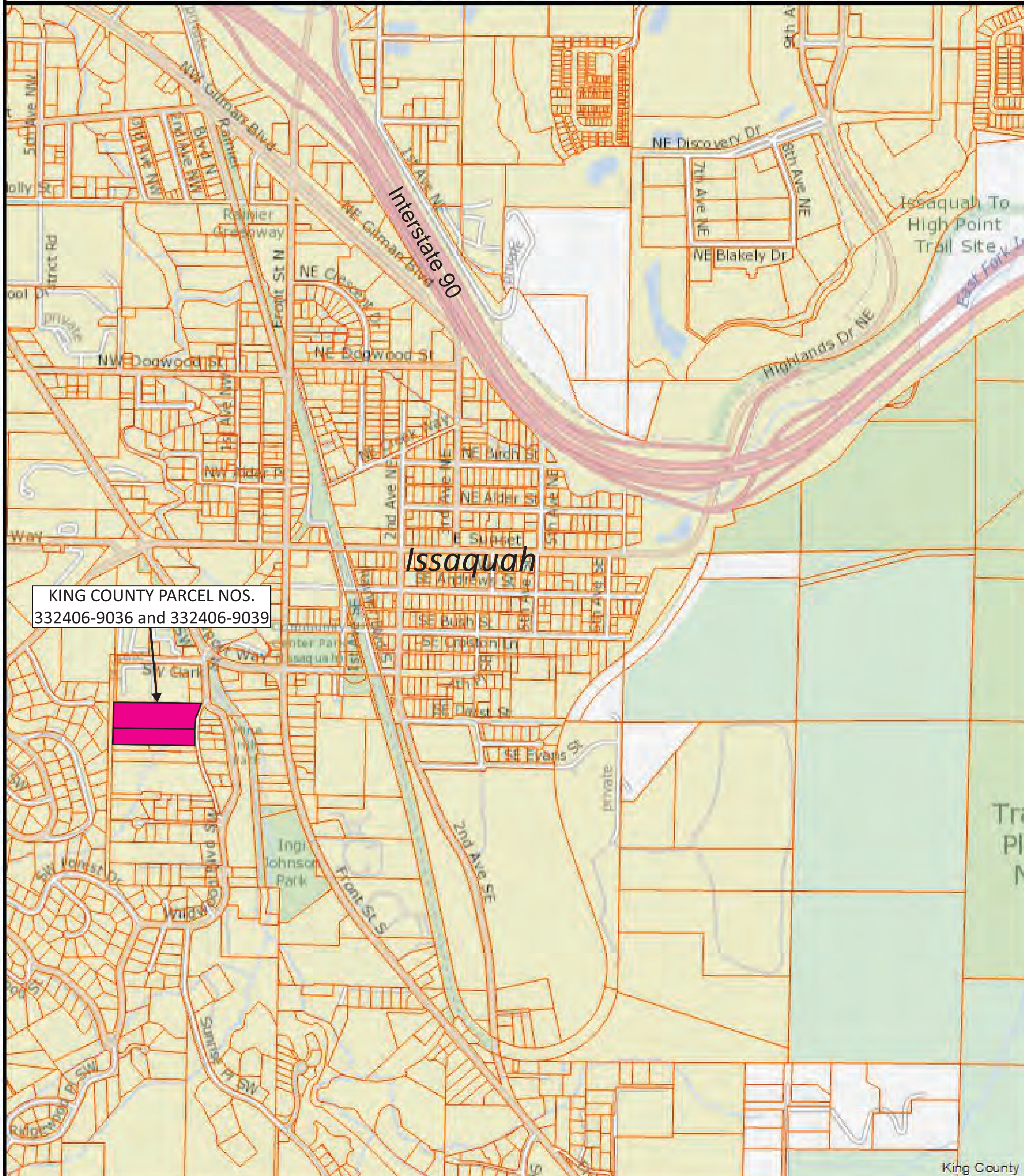
Document ID: 1131002.RevisedReport

Attachments: Figure 1 – Vicinity Map
Figure 2 – Site Plan
Figure 3 – Critical Areas Map
Figure 4 – Soil Classification System
Figures 5 through 9 – Test Pit Logs
Figure 10 – Moisture Content Test Results
Figure 11 – Particle Size Distribution Report
Attachment A - Global Stability Analysis – Slide 6.0 Output Files

Submitted via email and surface mail (one original copy)

FIGURES

King County iMap



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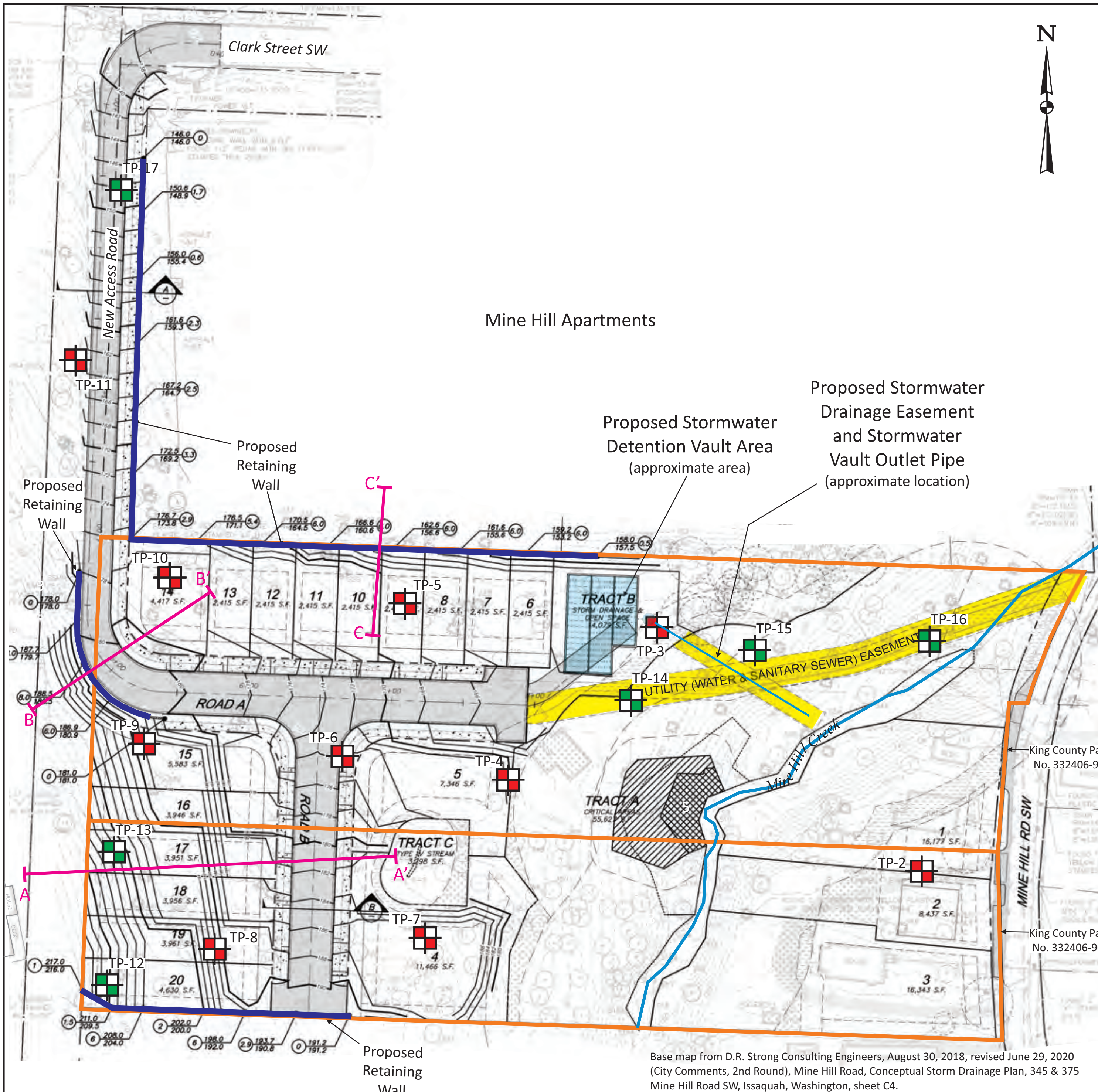
King County GIS Center

Date: 6/17/2015 Notes:

Based map obtained from King County iMap (https://gismaps.kingcounty.gov/iMap/)

VICINITY MAP	ICICLE CREEK ENGINEERS 29335 NE 20th Street Carnation, Washington 98014 (425) 333-0093	SCALE: None DESIGNED: --- DRAWN: JMS CHECKED: BRB/KSK DATE: 06/29/20	ICE FILE NO. 1131-002 Figure 1
KING COUNTY PARCEL NOS. 332406-9036 AND 332406-9039			



EXPLANATION

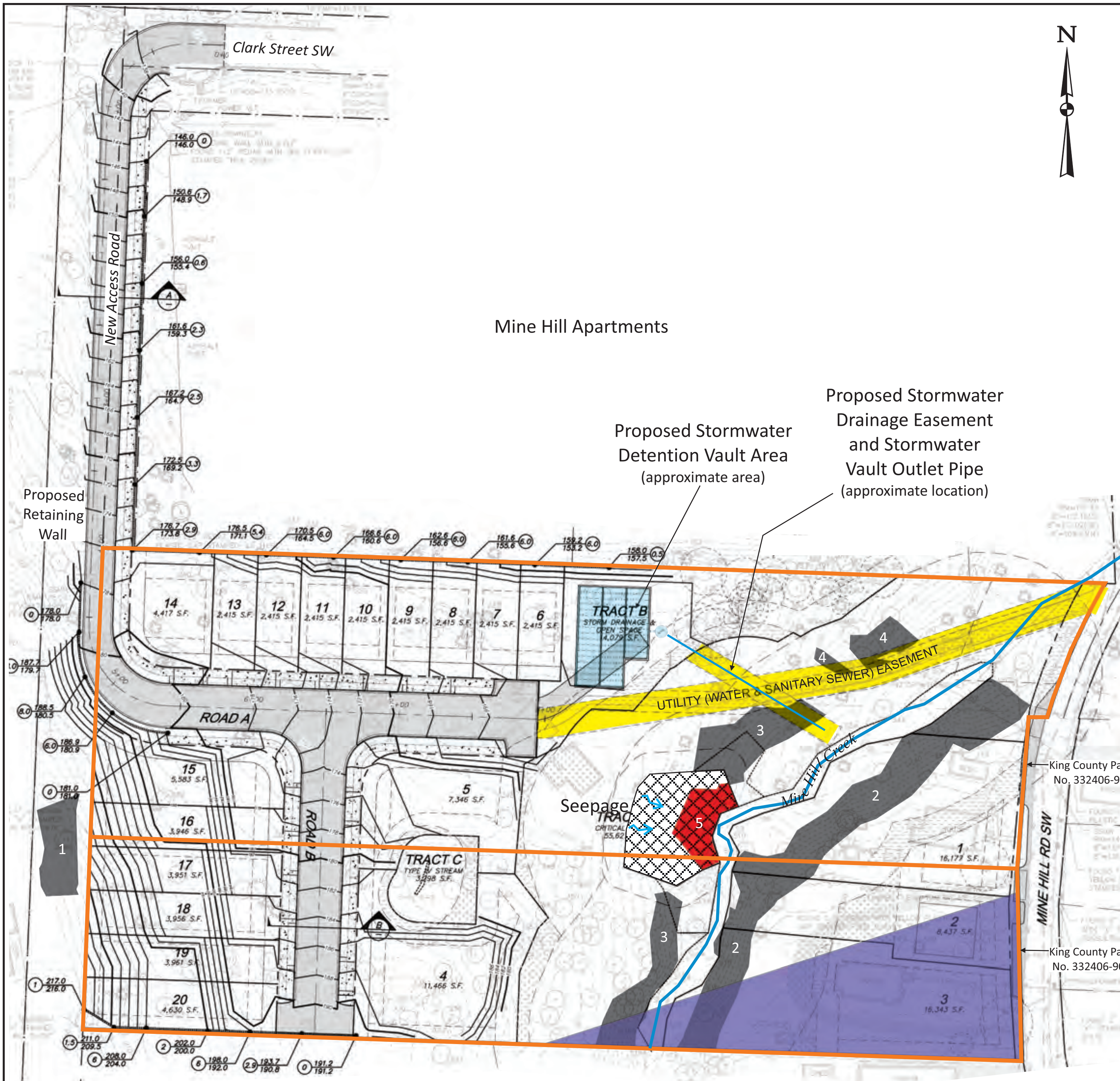
TP-12 Test Pit Location (completed on July 2, 2019)

TP-2 Test Pit Location (completed on April 1, 2016)

A A' Global Stability Analysis Critical Section Locations

0 50 100
Approximate Scale in Feet

SITE PLAN	ICICLECREEK ENGINEERS	SCALE: As Shown	ICE FILE NO.
	29335 NE 20th Street	DESIGNED: ---	1131-002
	Carnation, Washington 98014	DRAWN: JMS	Figure
KING COUNTY PARCEL NOS. 332406-9036 AND 332406-9039	(425) 333-0093	CHECKED: BRB/KSK	2
		DATE: 06/29/20	



EXPLANATION

5	**Steep Slope Hazard Area** - recommend buffer reduction (from IMC Chapter 18.10.580 A; see report section **8.2.2** for details)
1	**Steep Slope Hazard Area** - recommend exemption (from IMC Chapter 18.10.580.E.1; see report section **8.2.2** for details)
	Landslide Hazard Area (from IMC Chapter 18.10.390.B; see report section **8.2.3** for details)
	Moderate Coal Mine Hazard Area - requires mitigation (see report section **8.2.1** for additional details)

Notes: 1) The entire property is within an Erosion Hazard Area (IMC Chapter 18.10.390)
2) Base map from D.R. Strong Consulting Engineers, August 30, 2018, revised June 29, 2020 (City Comments, 2nd Round), Mine Hill Road, Conceptual Storm Drainage Plan, 345 & 375 Mine Hill Road SW, Issaquah, Washington, sheet C4.
3) IMC = Issaquah Municipal Code

0 50 100
Approximate Scale in Feet

CRITICAL AREAS MAP

KING COUNTY PARCEL NOS. 332406-9036 AND 332406-9039

ICICLECREEK ENGINEERS
29335 NE 20th Street
Carnation, Washington 98014
(425) 333-0093

SCALE: As Shown	ICE FILE NO.
DESIGNED: ---	1131-002
DRAWN: JMS	Figure
CHECKED: BRB/KSK	
DATE: 06/29/20	3

Unified Soil Classification System

MAJOR DIVISIONS			Soil Classification and Generalized Group Description	
Coarse-Grained Soils More than 50% retained on the No. 200 sieve	GRAVEL More than 50% of coarse fraction retained on the No. 4 sieve	CLEAN GRAVEL	GW	Well-graded gravels
			GP	Poorly-graded gravels
		GRAVEL WITH FINES	GM	Gravel and silt mixtures
			GC	Gravel and clay mixtures
	SAND More than 50% of coarse fraction passes the No. 4 sieve	CLEAN SAND	SW	Well-graded sand
			SP	Poorly-graded sand
		SAND WITH FINES	SM	Sand and silt mixtures
			SC	Sand and clay mixtures
Fine-Grained Soils More than 50% passing the No. 200 sieve	SILT AND CLAY Liquid Limit less than 50	INORGANIC	ML	Low-plasticity silts
			CL	Low-plasticity clays
		ORGANIC	OL	Low plasicity organic silts and organic clays
	SILT AND CLAY Liquid Limit greater than 50	INORGANIC	MH	High-plasticity silts
			CH	High-plasticity clays
		ORGANIC	OH	High-plasticity organic silts and organic clays
Highly Organic Soils	Primarily organic matter with organic odor		PT	Peat

Notes: 1) Soil classification based on visual classification of soil in general accordance with ASTM D2488.
2) Soil classification using laboratory tests is based on ASTM D2487.
3) Description of soil density or consistency is based on interpretation of blow count data and/or test data.

Soil Particle Size Definitions

Component	Size Range
Boulders	Greater than 12 inch
Cobbles	3 inch to 12 inch
Gravel	3 inch to No. 4 (4.78 mm)
Coarse	3 inch to 3/4 inch
Fine	3/4 inch to No. 4 (4.78 mm)
Sand	No. 4 (4.78 mm) to No. 200 (0.074 mm)
Coarse	No. 4 (4.78 mm) to No. 10 (2.0 mm)
Medium	No. 10 (2.0 mm) to No. 40 (0.42 mm)
Fine	No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt and Clay	Less than No. 200 (0.074 mm)

Soil Moisture Modifiers

Soil Moisture	Description
Dry	Absence of moisture
Moist	Damp, but no visible water
Wet	Visible water

SOIL CLASSIFICATION SYSTEM

KING COUNTY PARCEL NOS. 332406-9036 AND 332406-9039

ICICLECREEK ENGINEERS
29335 NE 20th Street
Carnation, Washington 98014
(425) 333-0093

SCALE: No Scale
DESIGNED: --
DRAWN: BRB
CHECKED: KSK
DATE: 06/29/20

ICE FILE NO.
1131-002
Figure
4

Depth (feet) [1]	Soil Group Symbol [2]	Test Pit Description [3]
Test Pit TP- 2		Approximate Ground Surface Elevation: 155 Feet
0.0 - 2.5	SM	Dark brown silty fine to medium SAND with occasional gravel (loose, moist) (Weathered Soil)
2.5 - 4.0	GP-GM	Brown fine to coarse GRAVEL with silt and sand (medium dense, moist) (Glacial Drift)
4.0 - 6.5	SM	Gray silty fine SAND with occasional gravel and fragments of bedrock (medium dense) (Highly Weathered Bedrock - Renton Formation)
6.5 - 8.0	SP	Light gray fine SAND (dense, moist) (Highly Weathered Bedrock - Renton Formation)
8.0 - 9.0	Rock	Gray fine-grained SANDSTONE (dense, moist) (Moderately Weathered Bedrock - Renton Formation)
		Test pit completed at about 9.0 feet on 04/01/2016
		Slow groundwater seepage observed at about 4.0 feet
		No caving of test pit walls observed
		Disturbed soil samples obtained at about 3.0 and 5.0 feet
Test Pit TP- 3		Approximate Ground Surface Elevation: 162 Feet
0.0 - 1.5	ML	Brown SILT with sand, gravel and roots up to 3 inches in diameter (soft to medium stiff) (Topsoil and Weathered Soil)
1.5 - 4.5	ML	Grayish-brown SILT (stiff, moist) (Glacial Drift)
4.5 - 10.0	ML	Gray SILT (very stiff to hard) (Glacial Drift)
10.0 - 12.5	SP	Brown fine to medium SAND with thin layers of silt (medium dense to dense, moist) (Glacial Drift)
12.5 - 14.0	SM/ML	Reddish-yellow and gray silty fine SAND and sandy SILT with a trace of fine gravel and fragments of coal (dense and hard, moist to wet) (Highly Weathered Bedrock - Renton Formation)
		Test pit completed at about 14.0 feet on 04/01/2016
		Slow groundwater seepage observed at about 13.5 feet
		Moderate caving of test pit walls observed from about 10.0 to 14.0 feet
		Disturbed soil samples obtained at about 5.0, 8.0, 10.0 and 13.0 feet
Test Pit TP-4		Approximate Ground Surface Elevation: 170 Feet
0.0 - 2.0	GM	Brown silty fine to coarse GRAVEL with sand and abundant roots (loose, moist) (Topsoil and Weathered Soil)
2.0 - 7.0	ML	Grayish-brown SILT with occasional thin layers of fine to medium sand (stiff, moist) (Glacial Drift)
7.0 - 8.0	SM	Brown silty fine SAND (medium dense, moist to wet) (Glacial Drift)
8.0 - 8.5	SP	Brown fine to medium SAND (medium dense, wet) (Glacial Drift)
		Test pit completed at about 8.5 feet on 04/01/2016
		Slow groundwater seepage observed at about 8.0 feet
		Slight caving of test pit walls observed for full depth of the test pit
		Disturbed soil samples obtained at about 3.0, 7.5 and 8.5 feet
Test Pit TP-5		Approximate Ground Surface Elevation: 164 Feet
0.0 - 2.0	ML	Dark brown sandy SILT with a trace of gravel and abundant roots (soft, moist to wet) (Topsoil and Weathered Soil)
2.0 - 4.0	ML	Light gray and reddish-yellow sandy SILT (medium stiff to stiff) (Highly Weathered Bedrock - Renton Formation)
4.0 - 7.0	SM	Orange silty fine to medium SAND with fragments of bedrock (medium dense to dense, moist) (Highly Weathered Bedrock - Renton Formation)
7.0 - 8.0	Rock	Gray fine-grained SANDSTONE (dense, moist) (Moderately Weathered Bedrock - Renton Formation)
		Test pit completed at about 8.0 feet on 04/01/2016
		Slow groundwater seepage observed at about 2.0 feet
		No caving of test pit walls observed
		Disturbed soil samples obtained at about 3.0 and 4.5 feet

See Notes on Figure 9

1131002/062920

Depth (feet) (1)	Soil Group Symbol (2)	Test Pit Description (3)
Test Pit TP- 6		Approximate Ground Surface Elevation: 179 Feet
0.0 - 2.0	SM	Dark brown silty fine to medium SAND with a trace of gravel and cobbles (loose, moist) (Topsoil and Weathered Soil)
2.0 - 3.0	SM	Grayish-brown silty fine to medium SAND with gravel (loose, moist) (Weathered Soil)
3.0 - 4.0	SP-SM	Brown fine to medium SAND with silt and a trace of gravel (medium dense to dense, moist) (Glacial Drift)
4.0 - 5.5	GP	Brown fine to coarse GRAVEL with sand and a trace of silt (dense, moist to wet) (Glacial Drift)
5.5 - 7.5	SM	Reddish-yellow silty fine SAND with occasional fragments of bedrock (dense, moist) (Highly Weathered Bedrock - Renton Formation)
7.5 - 8.0	Rock	Gray fine-grained SANDSTONE (dense, moist) (Moderately Weathered Bedrock - Renton Formation)
		Test pit completed at about 8.0 feet on 04/01/2016 Slow groundwater seepage observed at about 5.0 feet No caving of test pit walls observed Disturbed soil samples obtained at about 1.0, 3.5, 5.5 and 7.5 feet
Test Pit TP-7		Approximate Ground Surface Elevation: 185 Feet
0.0 - 1.5	ML	Dark brown sandy SILT wth a trace of gravel and abundant roots (soft, moist) (Topsoil)
1.5 - 3.5	ML	Brown and reddish-yellow sandy SILT with a trace of gravel and roots (medium stiff, moist) (Weathered Soil)
3.5 - 8.5	ML/SP	Gray interbedded sandy SILT with a trace of gravel and fine to medium SAND (stiff to very stiff and medium dense, moist) (Glacial Drift)
		Test pit completed at about 8.5 feet on 04/01/2016 Slow groundwater seepage observed at about 8.0 feet No caving of test pit walls observed Disturbed soil samples obtained at about 3.5 and 7.5 feet
Test Pit TP-8		Approximate Ground Surface Elevation: 200 Feet
0.0 - 2.0	ML	Dark brown sandy SILT with occasional gravel and abundant roots (soft, moist) (Topsoil)
2.0 - 3.5	ML	Brown SILT (soft, moist) (Weathered Soil)
3.5 - 5.0	SP	Brown fine to medium SAND with a trace of silt and gravel (dense, moist to wet) (Glacial Drift)
5.0 - 8.0	GP	Brown fine to coarse GRAVEL with sand and occasional cobbles (dense, wet) (Glacial Drift)
		Test pit completed at about 8.0 feet on 04/01/2016 Moderate groundwater seepage observed at about 4.5 feet Moderate caving of test pit walls observed from about 5.0 to 7.0 feet Disturbed soil samples obtained at about 2.5 and 4.0 feet
Test Pit TP- 9		Approximate Ground Surface Elevation: 194 Feet
0.0 - 1.5	ML	Dark brown SILT with sand, gravel, occasional cobbles and abundant roots (soft, moist) (Topsoil)
1.5 - 3.0	SM	Brown silty fine to medium SAND with gravel (loose, moist to wet) (Weathered Soil)
3.0 - 6.0	SM	Reddish-yellow to brown silty fine to medium SAND with fragments of bedrock (dense, moist) (Highly Weathered Bedrock - Renton Formation)
6.0 - 8.0	Rock	Gray fine-grained SANDSTONE (dense, moist) (Moderately Weathered Bedrock - Renton Formation)
8.0 - 8.5	Rock	Gray SILTSTONE (hard, moist) (Moderately Weathered Bedrock - Renton Formation)
		Test pit completed at about 8.5 feet on 04/01/2016 Slow groundwater seepage observed at about 3.0 feet No caving of test pit walls observed Disturbed soil samples obtained at about 1.0, 2.5 and 6.0 feet

See Notes on Figure 9 1131002/062920

Depth (feet) [1]	Soil Group Symbol [2]	Test Pit Description [3]
Test Pit TP-10		Approximate Ground Surface Elevation: 176 Feet
0.0 - 2.0	ML	Dark brown sandy SILT with sand, gravel and abundant roots (soft, moist to wet) (Topsoil)
2.0 - 4.0	ML/SM	Light gray and reddish-yellow sandy SILT and silty fine SAND with a trace of gravel (stiff to very stiff and medium dense to dense, moist) (Glacial Drift)
4.0 - 7.5	SM	Reddish-yellow silty fine to medium SAND with fragments of bedrock (dense, moist) (Highly Weathered Bedrock - Renton Formation)
7.5 - 8.5	Rock	Gray medium-grained SANDSTONE (dense, moist) (Moderately Weathered Bedrock - Renton Formation)
		Test pit completed at about 8.5 feet on 04/01/2016 Slow groundwater seepage observed at about 2.0 feet No caving of test pit walls observed Disturbed soil samples obtained at about 3.0, 5.5 and 8.0 feet
Test Pit TP-11		Approximate Ground Surface Elevation: 165 Feet
0.0 - 1.0	ML	Dark brown sandy SILT with gravel and occasional roots (soft, moist) (Topsoil)
1.0 - 3.0	ML	Brown sandy SILT (stiff, moist) (Glacial Drift)
3.0 - 5.5	GP	Brown fine to coarse GRAVEL with sand (dense, moist) (Glacial Drift)
5.5 - 7.5	ML	Reddish-yellow and gray SILT (hard, moist) (Highly Weathered Bedrock - Renton Formation)
7.5 - 8.5	ML	Gray SILT (hard, moist) (Highly Weathered Bedrock - Renton Formation)
8.5 - 9.0	Rock	Gray SILTSTONE (hard, moist) (Moderately Weathered Bedrock - Renton Formation)
		Test pit completed at about 9.0 feet on 04/01/2016 Slow groundwater seepage observed at about 5.5 feet No caving of test pit walls observed Disturbed soil samples obtained at about 2.0, 4.0 and 8.5 feet
Test Pit TP- 12		Approximate Ground Surface Elevation: 212 Feet
0.0 - 1.0	ML	Dark brown to brown sandy SILT with a trace of gravel and abundant roots (loose, moist) (Topsoil)
1.0 - 3.0	ML	Reddish-brown SILT with fine sand, a trace of gravel and abundant roots to a depth of about 2.5 feet (medium stiff, moist) (Weathered Soil)
3.0 - 6.5	ML	Reddish-brown to brown SILT (stiff to very stiff, moist) (Glacial Drift) with thin clay layers and moist to wet at about 6 .0 feet
6.5 - 8.5	GM	Reddish-brown silty coarse GRAVEL with sand and occasional fragments of bedrock (dense, moist) (Glacial Drift)
8.5 - 9.0	ML	Reddish-brown SILT with sand, gravel and bedrock fragments (Highly Weathered Bedrock)
		Test pit completed at about 9.0 feet on 07/02/2019 No groundwater seepage observed No caving of test pit walls observed Disturbed soil samples obtained at about 3.0, 6.0 and 8.0 feet

See Notes on Figure 9

1131002/062920

Depth (feet) [1]	Soil Group Symbol [2]	Test Pit Description [3]
Test Pit TP-13		Approximate Ground Surface Elevation: 203 Feet
0.0 - 1.0	ML	Dark brown to brown sandy SILT with a trace of gravel and abundant roots (loose, moist) (Topsoil)
1.0 - 3.0	ML	Brown gravelly SILT with sand and abundant roots to a depth of about 3.0 feet (medium stiff, moist) (Weathered Soil)
3.0 - 5.0	ML	Brown gravelly SILT with sand (stiff to very stiff, moist) (Glacial Drift)
5.0 - 7.0	ML	Light gray and reddish-brown gravelly SILT with sand with occasional cobbles (very stiff, moist) (Glacial Drift)
7.0 - 9.0	ML/GM	Grayish-brown SILT with sand, gravel and cobbles and silty GRAVEL with sand (very stiff/dense, moist) (Glacial Drift)
9.0 - 10.0	SM	Gray and reddish-brown silty fine to medium SAND with abundant fragments of bedrock (dense, moist to wet) (Highly Weathered Bedrock)
		Test pit completed at about 10.0 feet on 07/02/2019
		No groundwater seepage observed
		No caving of test pit walls observed
		Disturbed soil samples obtained at about 3.0. 6.0 and 9.5 feet
Test Pit TP-14		Approximate Ground Surface Elevation: 164 Feet
0.0 - 1.0	SM	Brown silty fine to medium SAND with gravel (medium dense, moist) (Fill)
1.0 - 3.0	ML	Light brown SILT (medium stiff, moist) (Weathered Soil)
3.0 - 5.0	SM	Laminated light brown silty fine SAND (medium dense, moist) (Glacial Drift)
5.0 - 6.0	ML	Light brown SILT with layers of silty fine sand and clay (very stiff, moist) (Glacial Drift)
6.0 - 10.0	SP-SM	Brown fine SAND with silt (medium dense to dense, moist to wet) (Glacial Drift)
		Test pit completed at about 10.0 feet on 07/02/2019
		Slow groundwater seepage observed at about 9.5 feet
		No caving of test pit walls observed
		Disturbed soil samples obtained at about 3.0, 4.5 and 6.0 feet
Test Pit TP- 15		Approximate Ground Surface Elevation: 156 Feet
0.0 - 1.0	ML	Dark brown to brown SILT with abundant roots (soft, moist) (Topsoil)
1.0 - 4.0	ML	Reddish-brown SILT with abundant roots to depth of about 2 feet (medium stiff, moist) (Weathered Soil)
4.0 - 6.0	ML	Reddish-brown SILT (stiff to very stiff, moist) (Glacial Drift)
6.0 - 10.0	SP-SM	Reddish-brown fine to medium SAND with silt and a trace of gravel (medium dense, moist) (Glacial Drift) becomes wet between about 8.0 and 8.5 feet (no seepage observed)
		Test pit completed at about 10.0 feet on 07/02/2019
		No groundwater seepage observed
		No caving of test pit walls observed
		Disturbed soil samples obtained at about 3.0, 5.0 and 9.0 feet
Test Pit TP- 16		Approximate Ground Surface Elevation: 128 Feet
0.0 - 1.0		4-inch diameter quarry spalls (Fill)
1.0 - 3.0	GP-GM	Brown fine to coarse GRAVEL with silt and sand (medium dense, moist) (Fill)
3.0 - 6.0	OL	Dark brown organic sandy SILT with wood fragments (soft, moist to wet) (Alluvium) with thin clay layers and moist to wet at about 6.0 feet
6.0 - 8.0	GP-GM	Brown fine to coarse GRAVEL with clay, silt, sand and occasional cobbles (medium dense, wet) (Alluvium) grades siltier/clayier with depth
		Test pit completed at about 8.0 feet on 07/02/2019
		Moderate groundwater seepage observed at about 7.0 feet
		Moderate caving of test pit walls observed at between about 6.0 and 8.0 feet
		Disturbed soil samples obtained at about 2.5, 4.0 and 7.0 feet

See Notes on Figure 9

1131002/062920

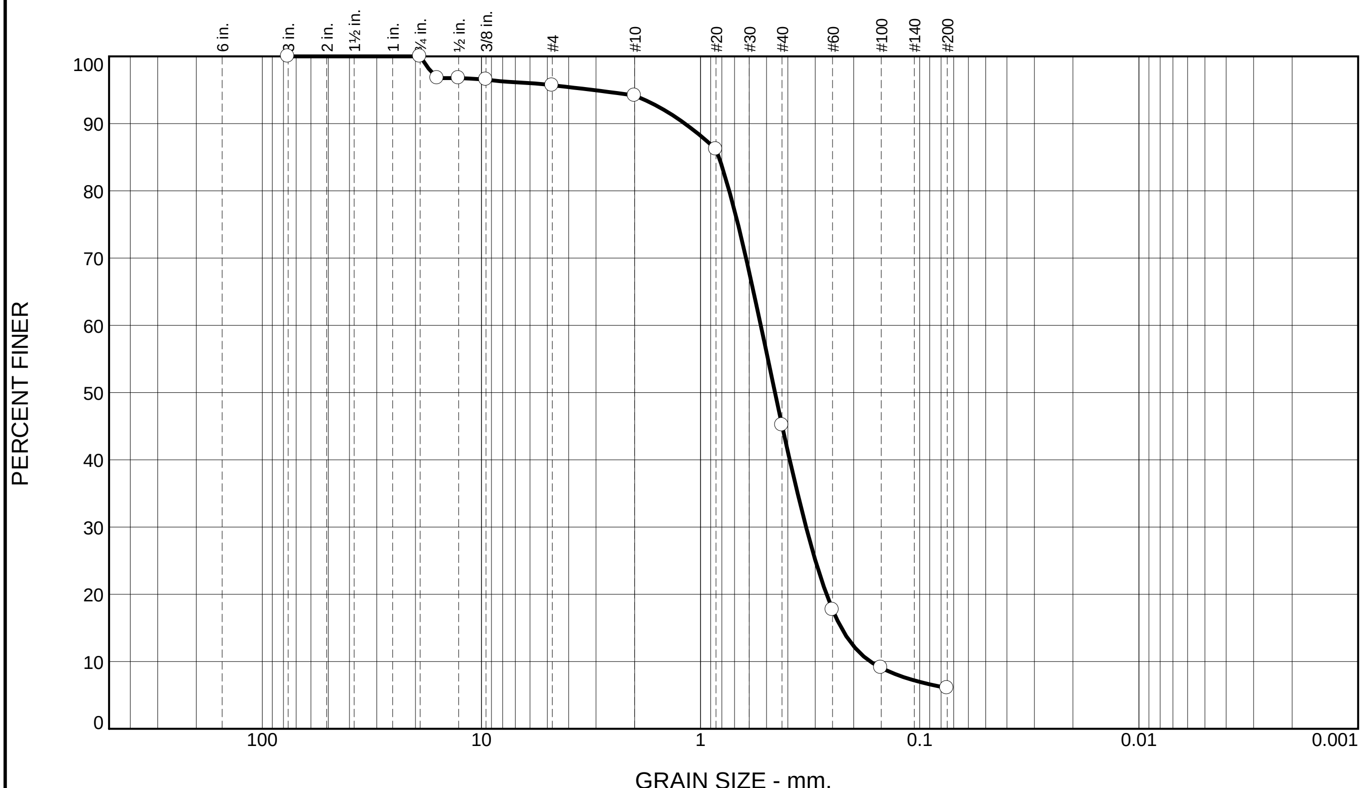
Depth (feet) [1]	Soil Group Symbol [2]	Test Pit Description [3]
Test Pit TP-17		Approximate Ground Surface Elevation: 148 Feet
0.0 - 0.5	GM	Dark brown silty fine to coarse gravel with sand and abundant roots (Fill)
0.5 - 1.5	GM	Brown silty fine to coarse GRAVEL with sand and occasional cobbles and abundant roots (medium dense, moist) (Fill)
1.5 - 3.0	SM	Light grayish-brown silty fine SAND with a trace of gravel and clasts of silt (medium dense, moist) (Fill)
3.0 - 5.0	ML	Brown, grayish-brown and reddish-brown SILT (medium stiff, moist) (Weathered Soil)
5.0 - 6.0	SP-SM	Brown fine to medium SAND with silt (medium dense, moist to wet) (Glacial Drift)
6.0 - 8.5	GP	Brown fine to coarse GRAVEL with sand (medium dense, moist to wet) (Glacial Drift)
8.5 - 9.0	ML	Grayish-brown clayey SILT with occasional gravel (stiff to very stiff, moist) (Highly Weathered Bedrock)
		Test pit completed at about 9.0 feet on 07/02/2019 No groundwater seepage observed No caving of test pit walls observed Disturbed soil samples obtained at about 1.0, 3.0, 5.0 and 6.0 feet

Notes:
(1) The depths on the test pit logs are shown in 0.5 foot increments, however these depths are based on approximate measurements across the length of the test pit and should be considered accurate to 1.0 foot. The depths are relative to the adjacent ground surface.
(2) The soil group symbols are based on the Soil Classification System, Figure 4.
(3) The approximate test pit locations are shown on the Site Plan, Figure 2.

Test Pit Number	Sample Number	Sample Approximate Depth (feet)	Moisture Content (Percent)
TP-2	S-1	3	8
	S-2	5	19
TP-3	S-1	5	29
	S-2	8	26
	S-3	10-11	19
	S-4	13	18
TP-4	S-1	3	25
	S-2	7.5	26
	S-3	8.5	25
TP-5	S-1	3	24
	S_2	4.5	27
TP-6	S-1	0-2	29
	S-2	10.5	20
	S-3	6	18
	S-4	8	9
TP-7	S-1	3.5	22
	S-2	7.5	20
TP-8	S-1	2.5	28
	S-2	4	25
TP-9	S-1	1	39
	S-2	2.5	10
	S-3	6	16
TP-10	S-1	3	26
	S-2	5.5	12
	S-3	8	14
TP-11	S-1	2	33
	S-2	4	10
TP-12	S-1	3	25
	S-2	6	31
	S-3	8	19
TP-13	S-1	3	16
	S-2	6	20
	S-3	9.5	13
TP-14	S-1	3	21
	S-2	4.5	26
	S-3	6	22

Test Pit Number	Sample Number	Sample Approximate Depth (feet)	Moisture Content (percent)
TP-15	S-1	3	23
	S-2	5	12
	S-3	9	20
TP-16	S-1	2.5	9
	S-2	4	43
	S-3	7	14
TP-17	S-1	1	5
	S-2	3	11
	S-3	5	32
	S-4	6	15

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.3	1.5	49.1	39.1	6.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
3/4"	100.0		
5/8"	96.8		
1/2"	96.8		
3/8"	96.5		
#4	95.7		
#10	94.2		
#20	86.2		
#40	45.1		
#60	17.7		
#100	9.1		
#200	6.0		

* (no specification provided)

Material Description

Brown fine to medium SAND with silt and a trace of gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 1.1795 D_{85}= 0.8250 D_{60}= 0.5315
D_{50}= 0.4576 D_{30}= 0.3301 D_{15}= 0.2279
D_{10}= 0.1680 C_u= 3.16 C_c= 1.22

Classification

USCS= SP-SM AASHTO= A-1-b

Remarks

Sampled by JMS 04/01/2016
Tested by JMS 05/13/2016 to 05/17/2016

Source of Sample: Test Pits **Depth:** 3.5 feet
Sample Number: TP-6, S-2 **Date:** 04/01/2016

ICICLE CREEK ENGINEERS, INC.

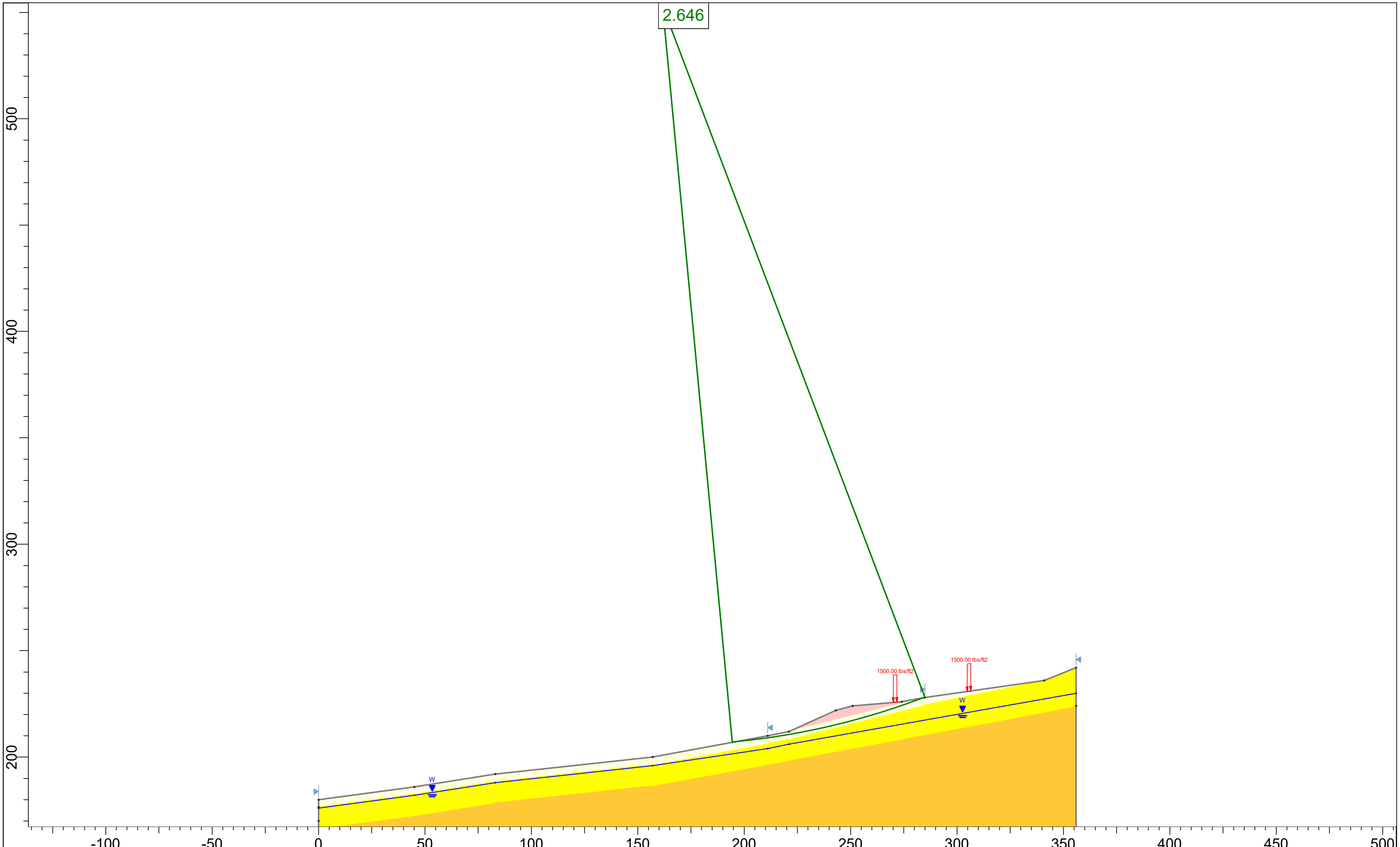
Carnation, WA

Client: Boardwalk Real Estate LLC
Project: Proposed 20-Lot Subdivision, King County Parcel Nos. 332406-9036 and 332406-9039, Issaquah, Washington
Project No: 1131-002 **Figure** 11

Tested By: JMS **Checked By:** KSK

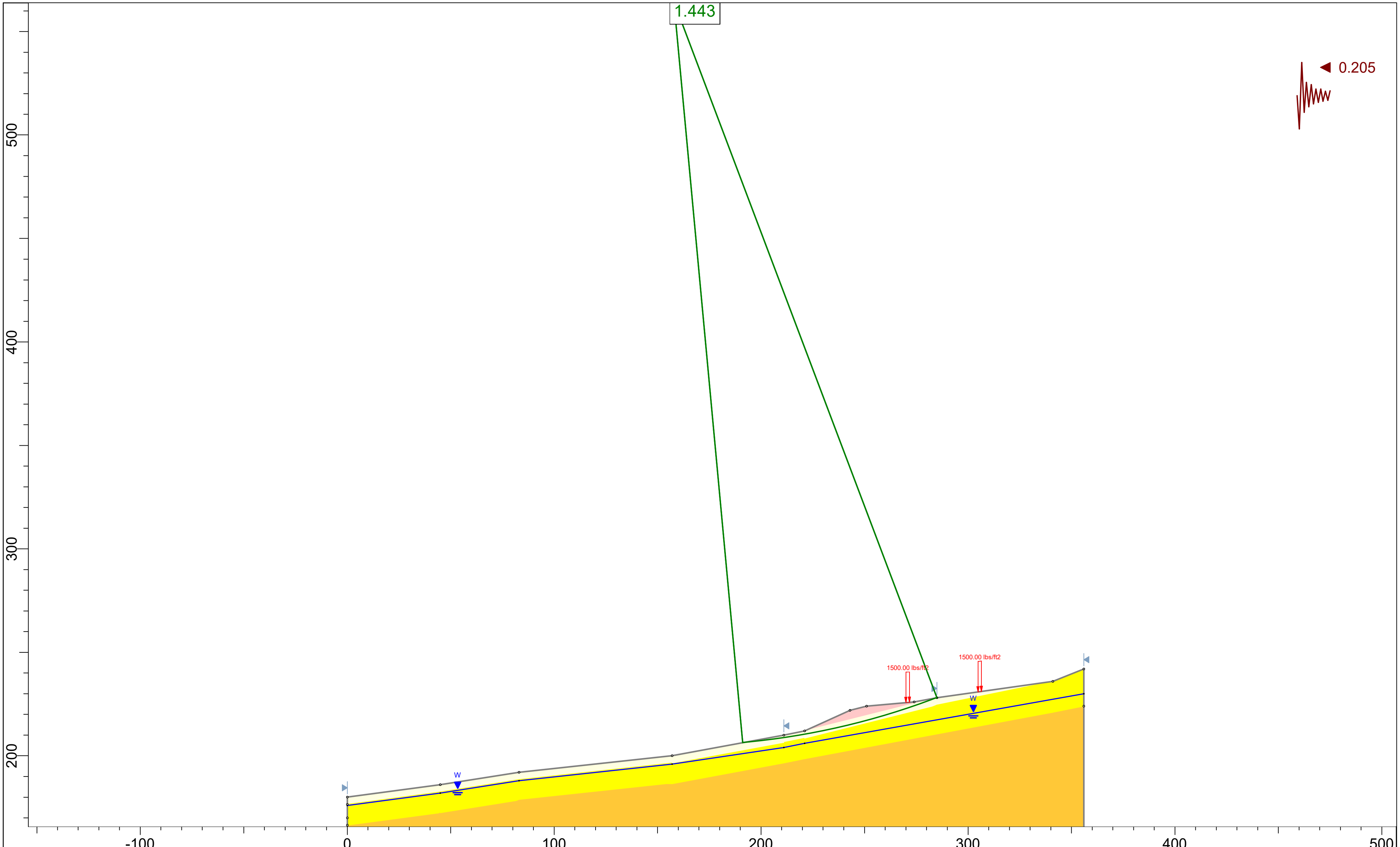
ATTACHMENT A

GLOBAL STABILITY ANALYSIS – SLIDE 6.0 OUTPUT FILES



Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description	Critical Section A-A', Before Development, Static		
Drawn By JMS	*Scale* 1:749	*Company*	Icicle Creek Engineers, Inc.
Date	5/21/2020, 8:51:00 AM	*File Name*	A-A'-existing-static-052120.slim

SLIDEINTERPRET 6.039



Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description	Critical Section A-A', Before Development, Seismic		
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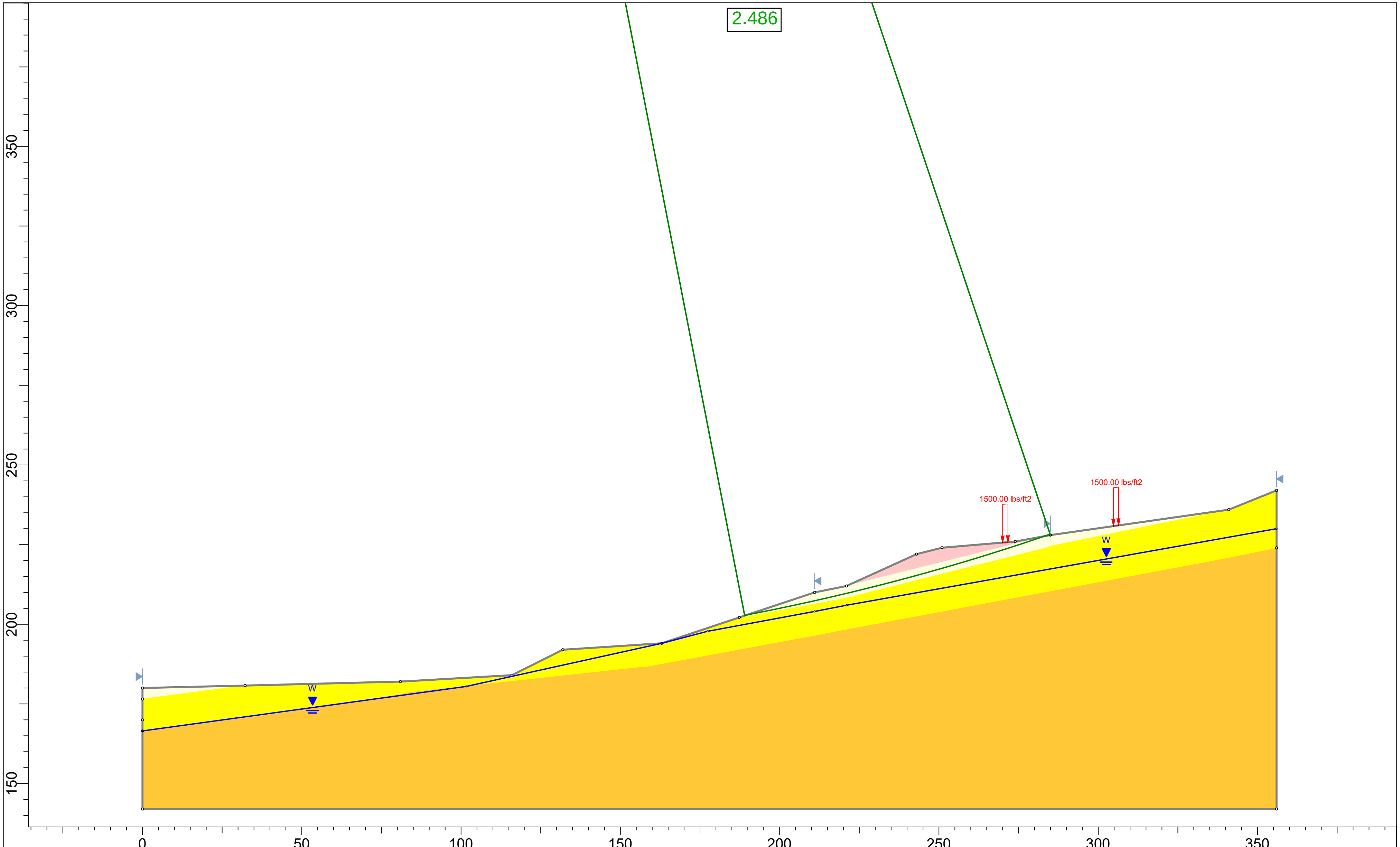
Date	5/21/2020, 8:51:00 AM	*File Name*	A-A'-existing-seismic-052120.slim

SLIDEINTERPRET 6.039



Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description	Critical Section A-A', After Development, Static		
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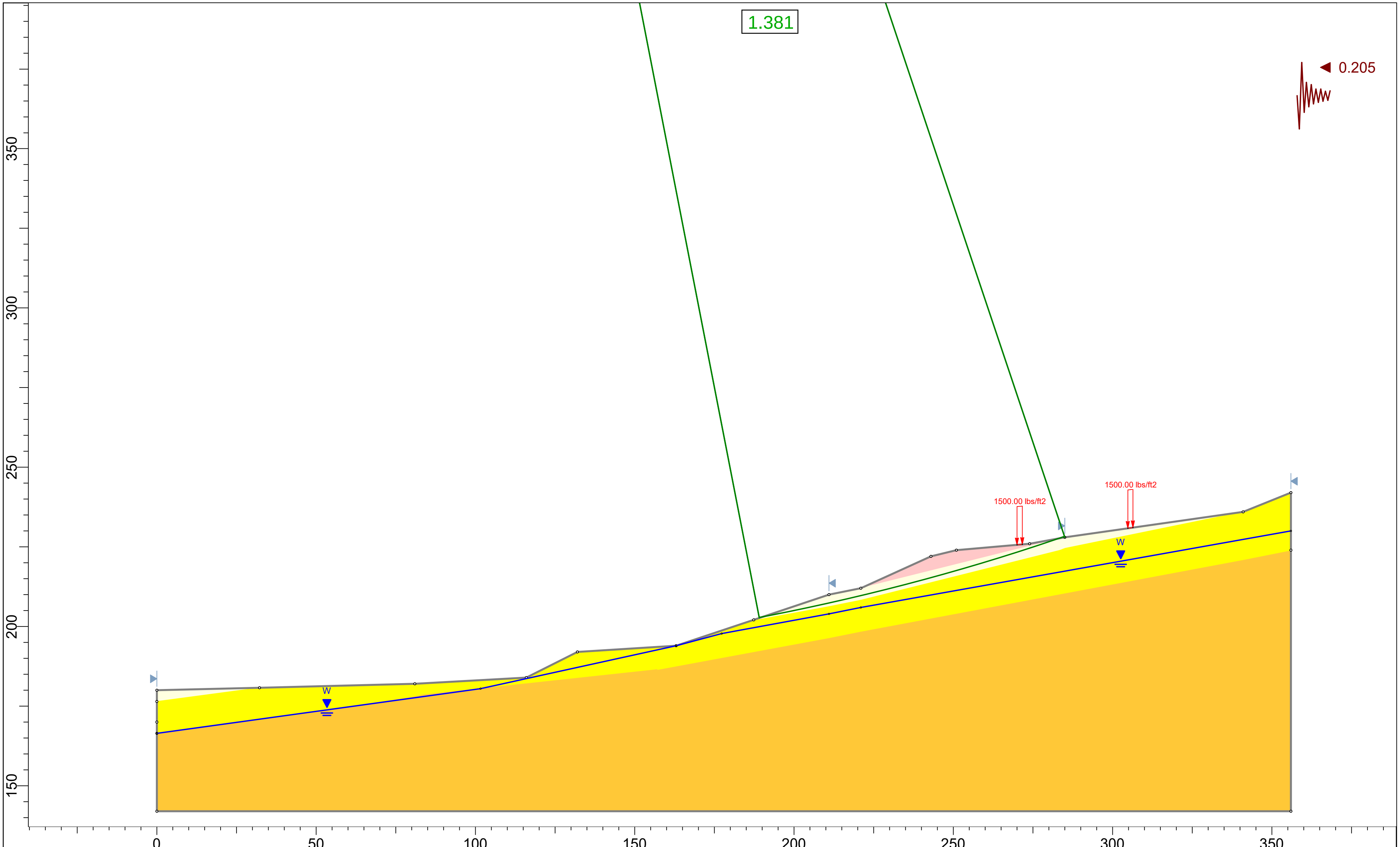
Date 5/21/2020, 8:51:00 AM		*File Name*	A-A'-proposed-static-052120.slim

SLIDEINTERPRET 6.039



SLIDEINTERPRET 6.039

Project	SLIDE - An Interactive Slope Stability Program
Analysis Description	Critical Section A-A', After Development, Seismic
Drawn By	JMS
Scale	1:500
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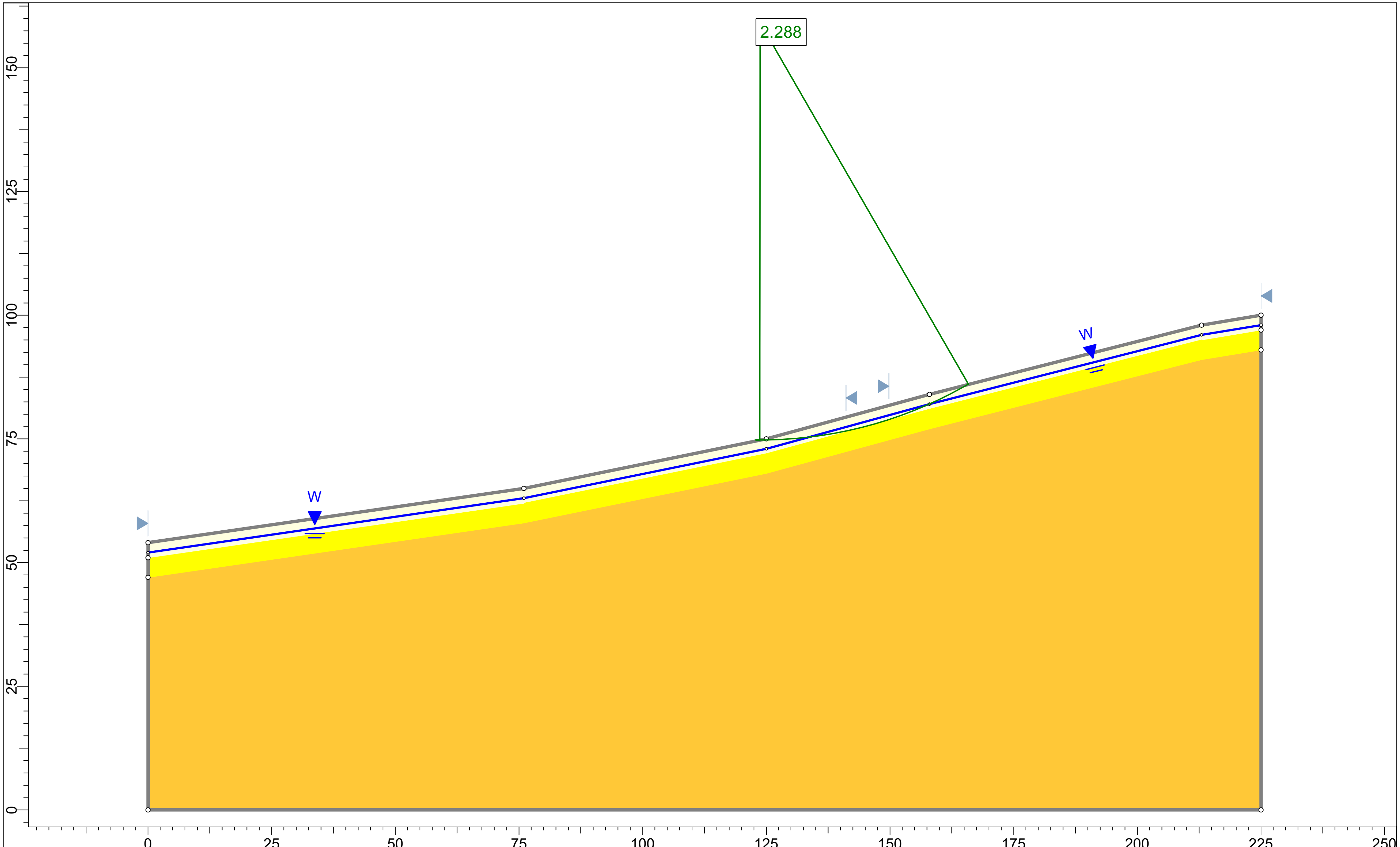
Date	5/21/2020, 8:51:00 AM
File Name	A-A'-proposed-seismic-052120.slim



Project	SLIDE - An Interactive Slope Stability Program		
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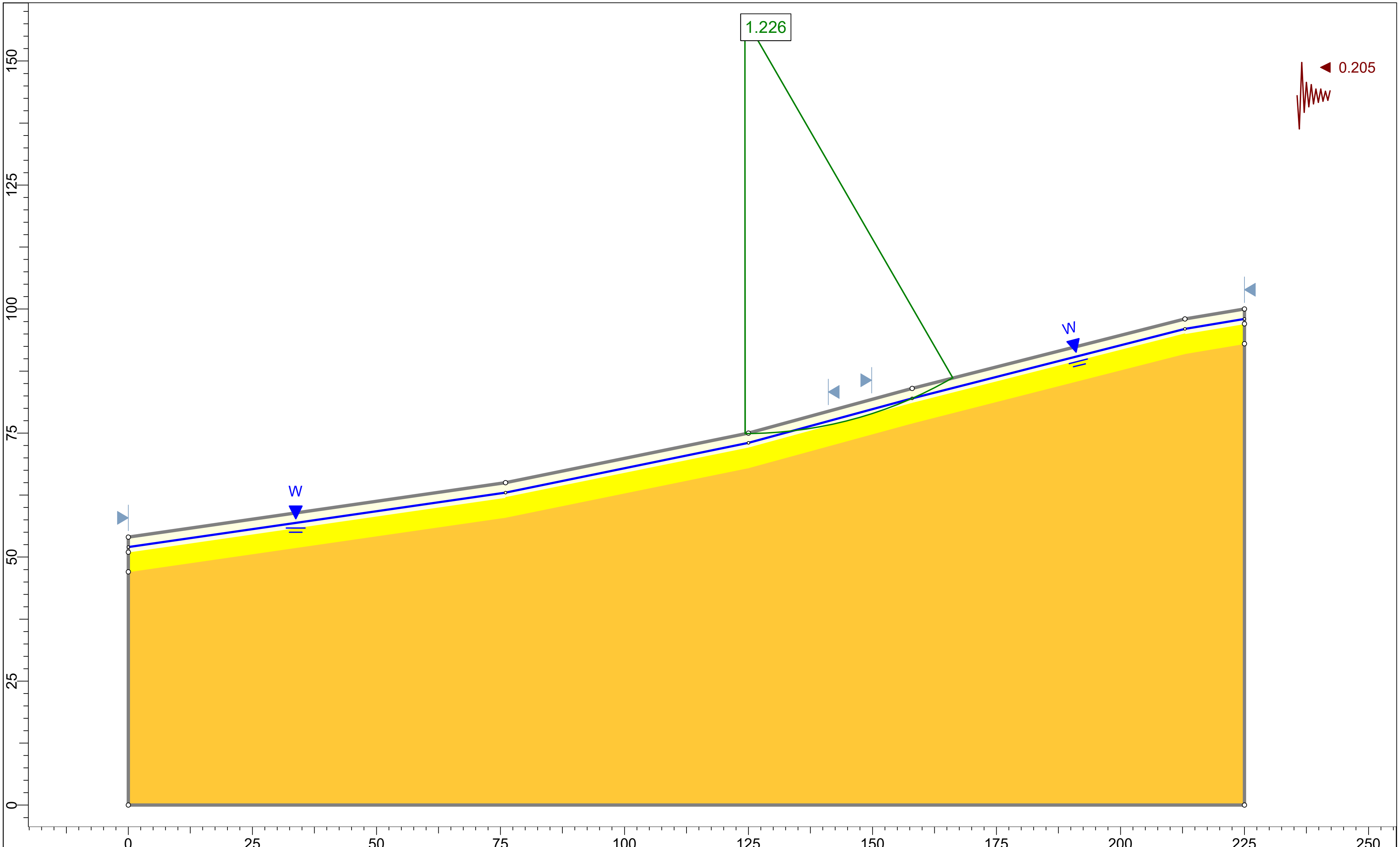
Date	7/17/2019, 11:07:37 AM	File Name	B-B'-exisitng-static.slim

SLIDEINTERPRET 6.039



SLIDEINTERPRET 6.039

Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description	Critical Section B-B', Before Development, Seismic		
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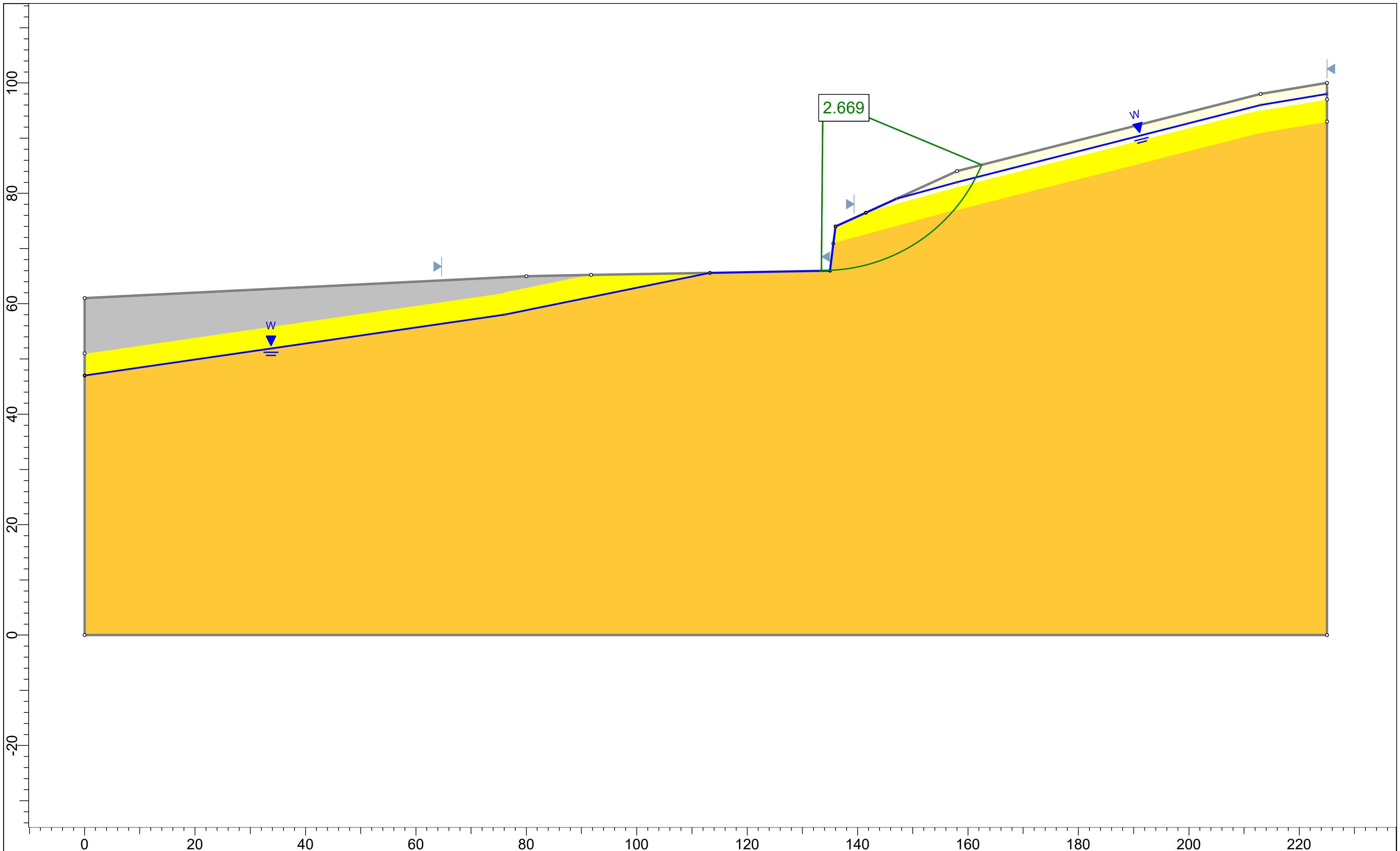
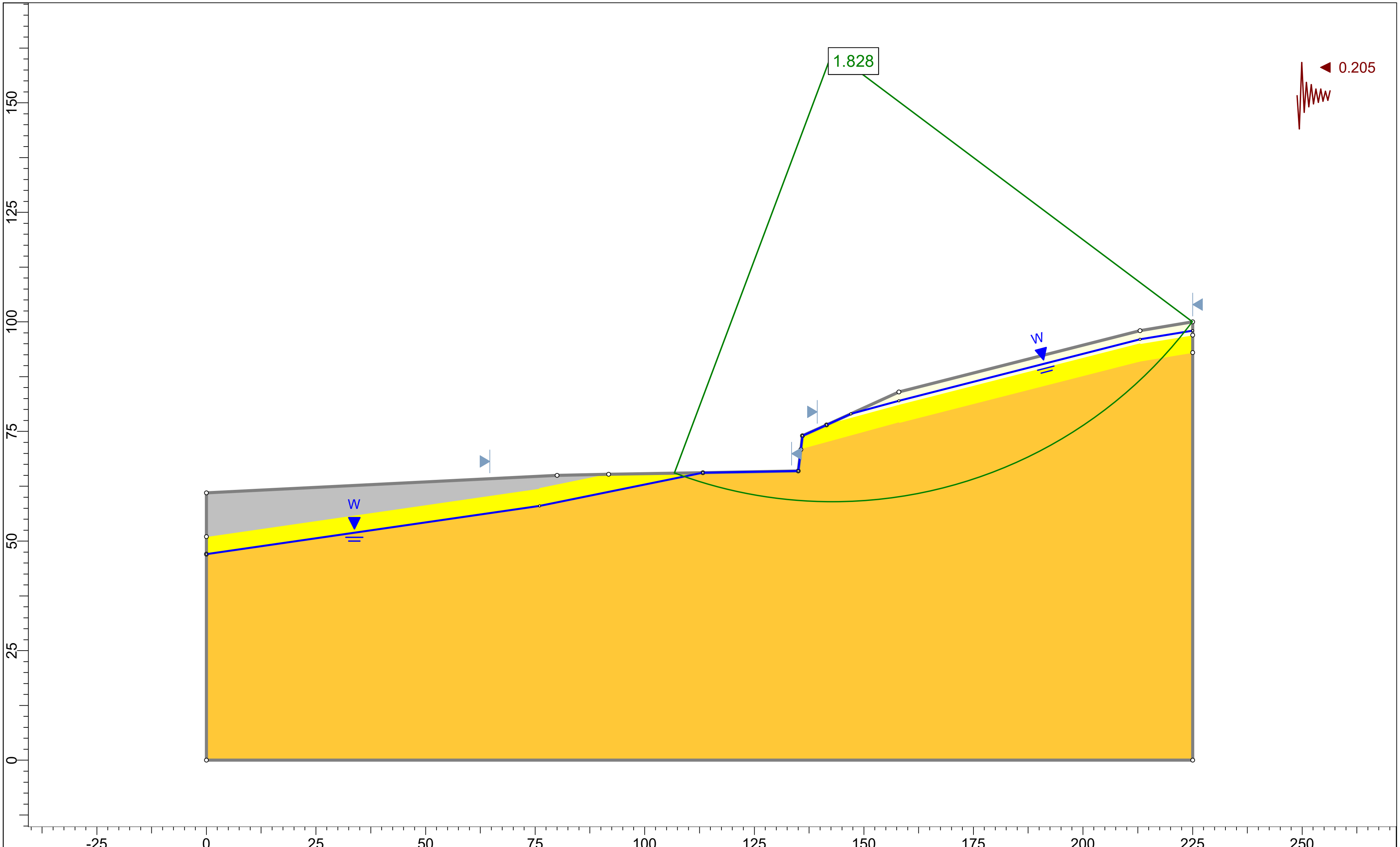
Date: 7/17/2019, 11:07:37 AM		File Name	B-B'-exisitng-seismic.slim



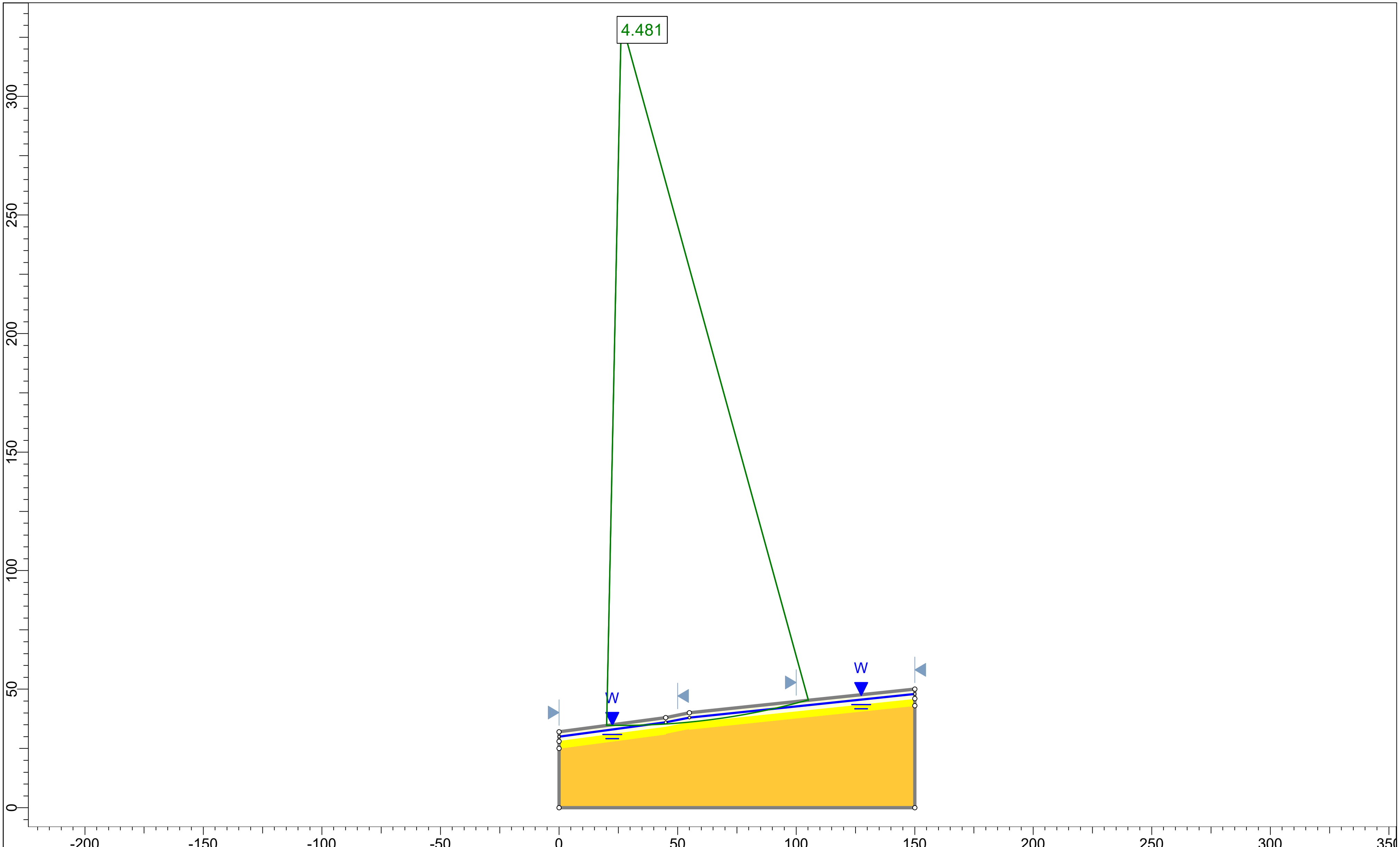
Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description	Critical Section B-B', After Development, Static		
Drawn By: JMS	Scale: 1:288	Company	Icicle Creek Engineers, Inc.
Date: 7/17/2019, 11:07:37 AM		File Name	B-B'-proposed-static.slim

SLIDEINTERPRET 6.039



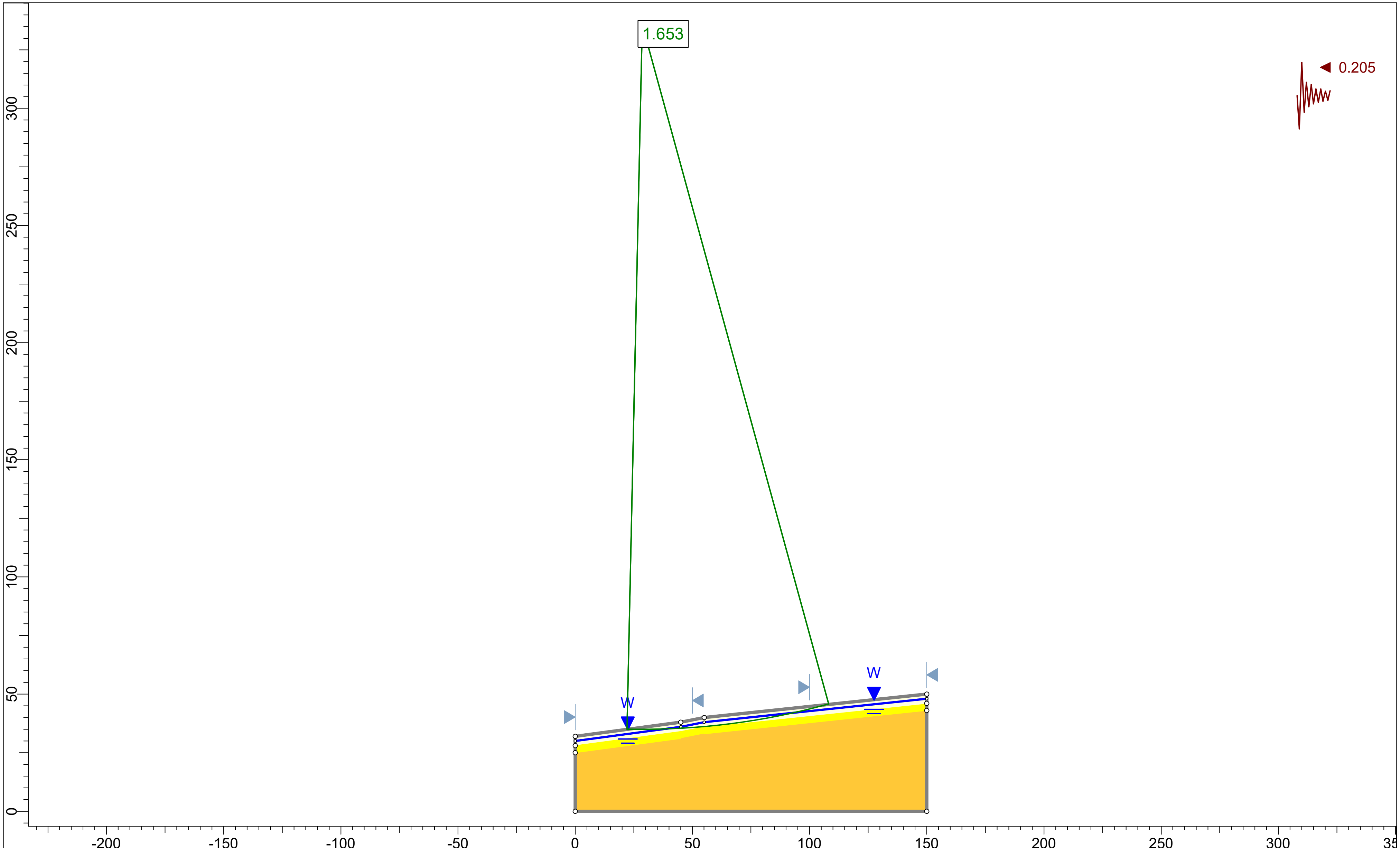
Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description	Critical Section B-B', After Development, Seismic		
Drawn By JMS	*Scale* 1:363	*Company*	Icicle Creek Engineers, Inc.
Date 7/17/2019, 11:07:37 AM		*File Name*	B-B'-proposed-seismic.slim

SLIDEINTERPRET 6.039



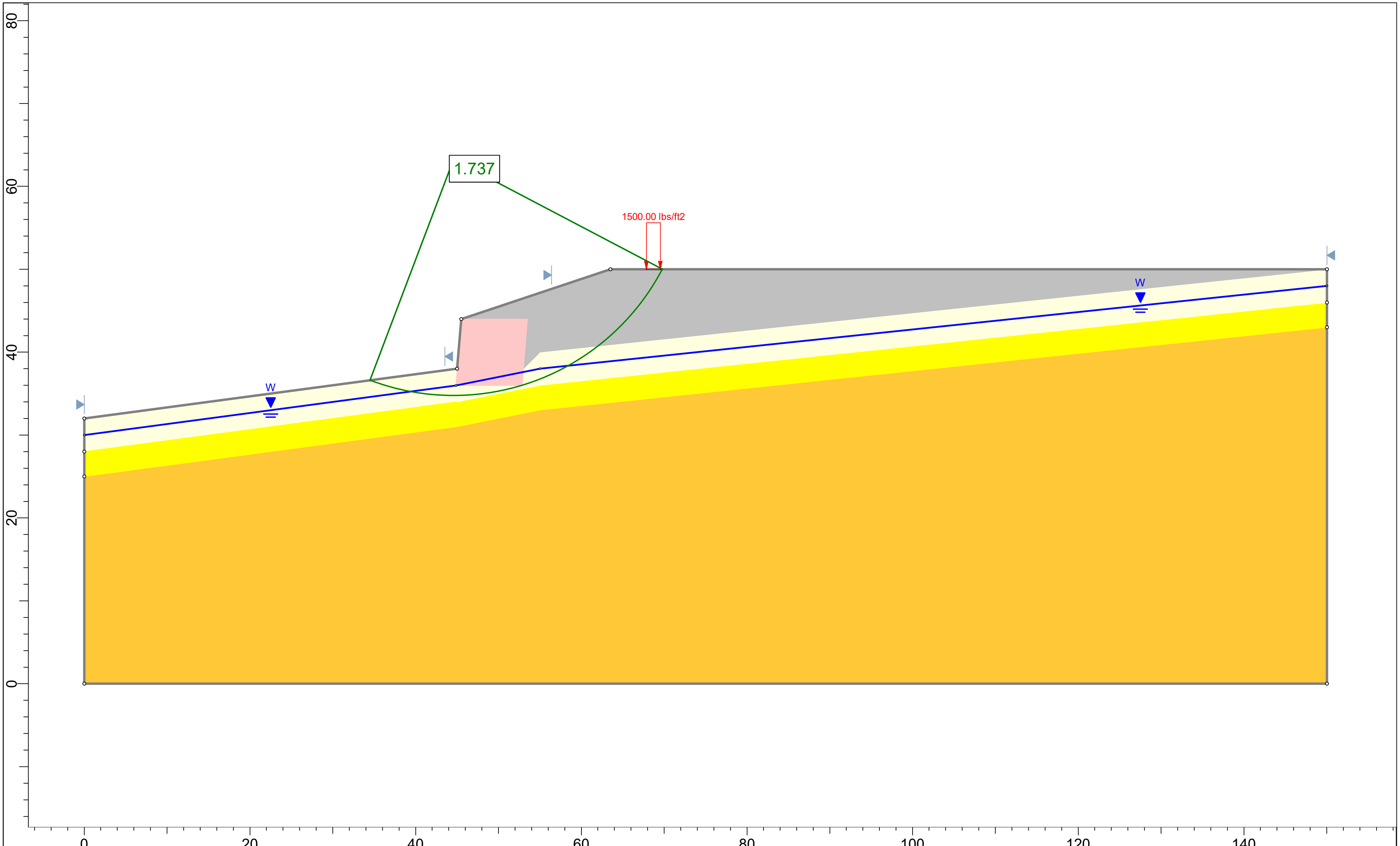
SLIDEINTERPRET 6.039

Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description	Critical Section C-C', Before Develoment, Static		
Drawn By JMS	*Scale* 1:672	*Company*	Icicle Creek Enginners, Inc.
Date	7/17/2019, 11:07:37 AM	*File Name*	C-C'-exisitng-static.slim



Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description	Critical Section C-C', Before Develoment, Seismic		
Drawn By JMS	Scale 1:680	Company	Icicle Creek Enginners, Inc.
Date 7/17/2019, 11:07:37 AM		File Name	C-C'-exisitng-seismic.slim

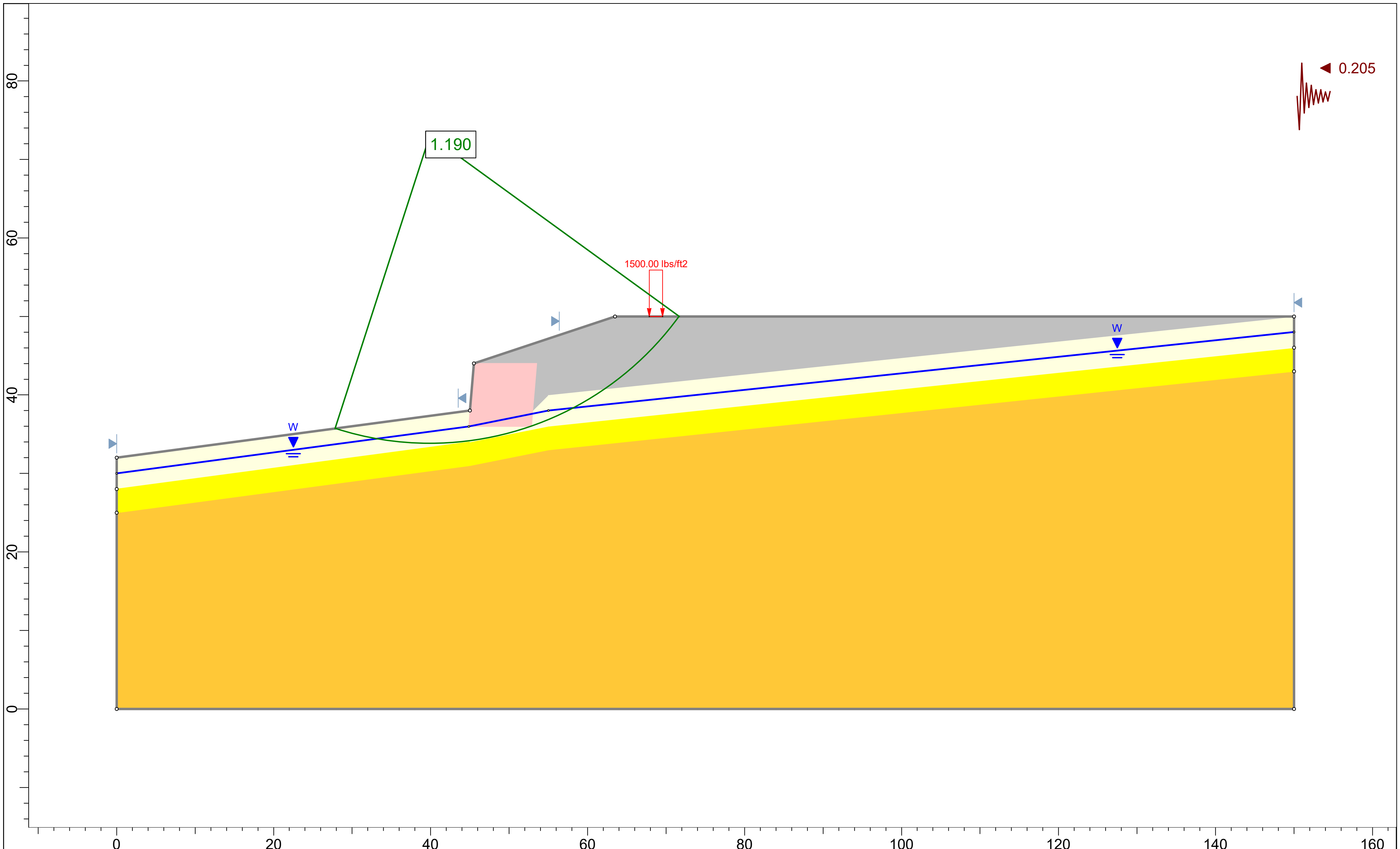
SLIDEINTERPRET 6.039



rocscience

SLIDEINTERPRET 6.039

Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description	Critical Section C-C', After Development, Static		
Drawn By JMS	*Scale* 1:192	*Company*	Icicle Creek Engineers, Inc.
Date	7/17/2019, 11:07:37 AM	*File Name*	C-C'-proposed-static.slim



Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description	Critical Section C-C', After Development, Seismic		
Drawn By JMS	*Scale* 1:203	*Company*	Icicle Creek Engineers, Inc.
Date	7/17/2019, 11:07:37 AM	*File Name*	C-C'-proposed-seismic.slim

SLIDEINTERPRET 6.039